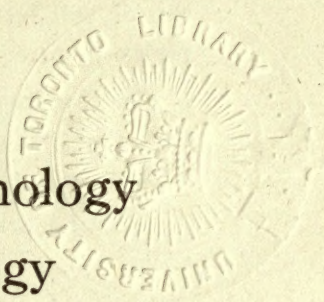






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TRANSACTIONS  
OF THE  
TWENTY-SIXTH ANNUAL MEETING  
OF THE  
American  
Academy of Ophthalmology  
and Oto-Laryngology



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HELD AT  
PHILADELPHIA, PA.  
OCTOBER 17-22, 1921

The Twenty-seventh Annual Meeting of the American Academy of Ophthalmology and Oto-Laryngology will be held at Minneapolis and St. Paul, Minn., September 19-23, 1922. The attention of the members is called to the ruling of the Council, that when a paper published in the Transactions is illustrated, the author must pay the total cost of all colored plates, and one-half of the cost of all other cuts. The Editor will furnish an estimate of the cost of such cuts and plates upon request.

Only those members will receive the Transactions who have paid their dues by March 1st of the year for which the Transactions are published.

Printing arrangements makes this rule of the Academy necessary.

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# JOINT SESSIONS

## TABLE OF CONTENTS

### PAGE

President's Address.

EMIL MAYER, M.D., New York City..... 1

Industrial Trauma in Relation to the Development of  
Ocular Tuberculosis, Syphilis and Neoplasms.

HANS BARKAN, M.D., San Francisco, Cal..... 9

Industrial Diseases of the Ear, Nose and Throat.

JOHN A. DONOVAN, M.D., Butte, Mont..... 19

Industrial Ophthalmology.

GEORGE H. CROSS, M.D., Chester, Pa..... 34

Ophthalmology and Social Service.

PERCY H. FRIDENBERG, M.D., New York City... 41

The Value in Diagnosis and Treatment of a Complete  
Examination by an Oto-Laryngologic Group.

JOSEPH C. BECK, M.D., and HARRY L. POLLOCK,  
M.D., Chicago, Ill..... 53

Progress in Graduate Teaching of Ophthalmology.

EDWARD JACKSON, M.D., Denver, Colo..... 62

Specimens Illustrating Operative Aural Surgery and the  
Making of Similar Dissections by Graduate Students,  
in Teaching Aural Surgical Anatomy.

EDWARD B. GLEASON, M.D., Philadelphia, Pa... 75

# OPHTHALMOLOGICAL DIVISION

## TABLE OF CONTENTS

	PAGE
The Muscle Advancement Operation: I, A Twin Single Stitch Method. II, Remarks on Tendon Transplanta- tion, with Report of a Case.	
WM. CAMPBELL POSEY, M.D., Philadelphia, Pa...	83
Capsulo-Muscular Advancement Without Incision.	
S. LEWIS ZIEGLER, M.D., Philadelphia, Pa.....	90
Prisms: Should They be Prescribed for Constant Use?	
F. W. DEAN, M.D., Council Bluffs, Iowa.....	108
Unusual Glaucoma Cases.	
WM. THORNWALL DAVIS, M.D., Washington, D. C.	119
Use of Gullstrand Slit Lamp.	
HARRY S. GRADLE, M.D., Chicago, Ill.....	126
Ocular Growths of a Nevoid Character.	
HARVEY D. LAMB, M.D., St. Louis, Mo.....	135
Nonsurgical Treatment of Malignant Epibulbar Neo- plasms.	
EDWARD B. HECKEL, M.D., Pittsburgh, Pa.....	149
Blepharoplasty for Restoration of the Socket.	
WM. C. FINNOFF, M.D., Denver, Colo.....	154
Practical Points in Blepharoplasty.	
WALTER R. PARKER, M.D., Detroit, Mich.....	161
A New Procedure in Plastic Surgery of the Conjunctiva.	
LEE MASTEN FRANCIS, M.D., Buffalo, N.Y.....	181
An Examination of the Eye Magnets in Most Common Use, with a Description of New Models for Use with Dry Cells.	
WALTER B. LANCASTER, M.D., Boston, Mass.....	186
A Case of Socalled Solid Edema.	
ARTHUR J. BEDELL, M.D., Albany, N. Y.....	201
Congenital Anterior Cataract.	
L. D. BROSE, M.D., Evansville, Ind.....	209
Enucleation with Implantation in Tenon's Capsule.	
WALLACE RALSTON, M.D., Houston, Tex.....	216
Some Observations on the Structure of the Vitreous Body.	
F. PARK LEWIS, M.D., Buffalo, N. Y.....	224

# OTO-LARYNGOLOGICAL DIVISION

## TABLE OF CONTENTS.

	PAGE
Pt. I: Papillomata of the Larynx with Presentation of Patients. Pt. II, Overlooked Cases of Foreign Body in the Lung.	
CHEVALIER JACKSON, M.D., Philadelphia, Pa.....	229
Localization of Lung Abscesses.	
HENRY LOWNDES LYNNAH, M.D., New York City..	232
Some of the Problems Which May Confront the Occasional Broncho-esophagoscopist.	
RICHARD MCKINNEY, M.D., Memphis, Tenn.....	243
Recent Observations on Laryngo-Pulmonary Tuberculosis.	
JULIUS DWORETZKY, M.D., Liberty, N. Y.....	254
Acute Infections into the Sebaceous Glands and Hair Follicles of the Nasal Vestibule.	
LEE M. HURD, M.D., New York City.....	263
Acoustic Neuromas.	
JOHN J. SHEA, M.D., Memphis, Tenn.....	267
Study of the Schwabach Test in One Hundred Cases.	
ROBERT SONNENSCHNEN, M.D., Chicago, Ill.....	278
Some Remarks on the Weber, Schwabach and Rinne Tests.	
GEORGE W. MACKENZIE, M.D., Philadelphia, Pa..	295
The Weber Test and Some Practical Considerations of the Functional Examination of the Hearing Tests.	
ELBRYNE G. GILL, M.D., Roanoke, Va.....	306
A Study of the Tonal Range in Lesions of the Acoustic Nerve and Labyrinth.	
L. W. DEAN, M.D., and C. C. BUNCH, Ph.D., Iowa City, Iowa.....	316
Observations on Lateral Sinus Thrombosis Following Mastoiditis, with Report of Case.	
JOHN MCCOY, M.D., New York City.....	341
Total Blindness of Both Eyes Cured by Drainage of Sphenoid and Ethmoid Cells.	
JAMES J. KING, M.D., New York City.....	348
The Moure Operation for the Removal of Large Growths and Foreign Bodies from the Antrum.	
VIRGINIUS DABNEY, M.D., Washington, D. C.....	353

A New Surgical Technic for the Operative and Postoperative Treatment of Maxillary Sinus Disease.	
HENRY B. LEMERE, M.D., Omaha, Neb.....	358
Causes of Failure in Surgery of the Nasal Accessory Sinuses.	
WILLIAM MITHOEFER, M.D., Cincinnati, Ohio.....	374
Epiglottidectomy for the Relief of Congenital Laryngeal Stridor, with Report of a Case.	
SAMUEL IGLAUER, M.D., Cincinnati, Ohio.....	390
Oration: Relation Between the Eye and the Ear (Including the Vestibular Organ).	
PROF. J. VAN DER HOEVE, Leiden, Holland.....	395
Presentation of Instruments.....	412-432
Presentation of a Mercury Tonometer.	
MARTIN COHEN, M.D., New York City.....	412
A New Tonsil Snare.	
HORACE NEWHART, M.D., Minneapolis, Minn.....	415
A New Sliding Dose Tuberculin Syringe.	
EDWIN B. MILLER, M.D., Philadelphia, Pa.....	416
A Handy Phorometer.	
DAVID W. WELLS, M.D., Boston, Mass.....	418
Method of Measuring the Strength of the Internal Rectus.	
LUCIEN HOWE, M.D., Buffalo, N. Y.....	419
Instrument for Determining the Location of Optical Iridectomy.	
HARRY S. GRADLE, M.D., Chicago, Ill.....	420
A Test Card.	
G. A. SULZER, M.D., Columbus, O.....	420
A New Tonsil Hemostatic Forceps for Ligating Vessels in the Tonsil Fossa.	
HOWARD V. DUTROW, M.D., and ALFRED G. FARMER, M.D., Dayton, Ohio.....	421
Special Tonsil Forceps.	
GEORGE B. JOBSON, Franklin, Pa.....	422
Goggles for Patients to be Operated.	
SAMUEL S. QUITTNER, Cleveland, O.....	422
Ice Bag for Operated Tonsil Cases.	
FRANCIS CHAPMAN, M.D., Milwaukee, Wis.....	422
New Paracentesis Knife.	
FRANCIS CHAPMAN, M.D., Milwaukee, Wis.,.....	422
New Headlight.	
CHARLES R. REEVES, Greensboro, N. C.....	422
Necrology .....	424
Minutes .....	425-449

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JOINT SESSIONS



## PRESIDENT'S ADDRESS.

EMIL MAYER, M.D.

NEW YORK CITY.

Honored Guests, Ladies and Gentlemen, Fellows of the Academy:

The honor of election to the Presidency of this Academy, to have the honor of membership in that galaxy of my capable and efficient predecessors, and above all the evidence of your high confidence in being deemed worthy of the greatest gift in your power, is so great, that words of thanks seem empty to express my deep appreciation and gratitude.

Deeds can only supplement those words, and these have been freely rendered you and will be continued to the best of my ability until my task is finished.

The duties of the President begin with his election, and twelve months of close and arduous attention to the many problems arising in a vigorous and healthy body like this Academy are required.

Fortunately, the Council helps decide all constitutional questions, the Purser remains the same watchful guardian, and the old reliable Pilot, the Secretary, has been as always, a powerful, efficient and willing guide. By resolution of the Council, an Assistant Secretary was appointed by me, and Dr. Jas. J. King of New York has acted most capably. This innovation has worked well, and its continuance is advisable. In the business meeting you have learned what the various Committees have been doing. We are indeed proud of the splendid showing thus far made in the postsessional program. The hearty cooperation, already assured, of our members, does not require much foresight to prophecy the fullest possible success.

This postsessional meeting marks a step forward in medical gatherings that is unique. Originally suggested by Dr. S. H. Large, it was proposed last year by Dr. Allen Greenwood, and most enthusiastically taken up by that efficient and hard working Committee of Drs. Gradle, Wiener, Wherry and H. W. Loeb, who have had the cordial support and assistance of the officers of the Association.

The new arrangement with the pathologic Bureau of the

U. S. Army, will be a splendid addition to the scientific work of this Academy, enabling members in the smallest cities to be as near to the pathologist as those in the largest cities.

The examining Board in Oto-Laryngology is now functioning, and candidates may be admitted only after proper examination.

When other National Associations in this Branch have established methods similar to the Ophthalmologic, we shall be able to issue the same certificate of proficiency.

The appointment of a proper Committee to confer with these Associations to this end is most essential.

The scientific program is by vote of the Council limited to a certain number of papers, and hence to our great regret we were unable to accept many papers that were offered.

In arranging the program we have tried to be mindful of the fact that the one cardinal principle of the Academy is to encourage the younger members to contribute scientific communications.

During the past twelve months the members of the Academy in this City of Philadelphia have worked untiringly toward a successful meeting from every point of view, their sole object being that the high standards set in our previous meetings shall be not only equalled but surpassed.

Your officers have acted in harmony with their lofty ideals, and a successful meeting will be ample reward for their faithful and cordial loyalty to the Academy.

In accordance with our custom I have the honor to present the inaugural address, and have selected a few subjects which I feel that we should consider, regarding our relation as members of our great profession to the Public, and secondly our relation as Specialists to the Public.

Mindful of the fact that a full program awaits us, and also that as President, an example should be shown, I shall be brief, and hence ask your kind consideration if I do not go exhaustively into the subjects mentioned. Permit me then to speak first of

#### THE RELATION OF THE MEDICAL PROFESSION TO THE PUBLIC.

For many reasons, perhaps because of our code of Ethics, or Rules of Conduct, our diffidence, or that its importance is not appreciated, there exists a woeful lack of knowledge on the part of the general Public as to many of the aims of our Profession, our constant endeavors to serve the Public, the

many sacrifices we make in this field and our whole-hearted sincerity in so doing.

It is a general belief that Doctors, old and young, in our larger hospitals are paid for their services, when as a matter of fact they are the only ones who receive no remuneration.

Attendance of the Doctor at medical meetings at his own expense is considered something of a glorious holiday. It is not known how much thought and time is given to the preparation of a scientific paper, how convincingly accurate it must be, how searchingly the statements therein contained are investigated, how free and open the debate thereon and the opportunity the reader has to combat any criticism.

The faithful attendance at all meetings during the sessions, a strongly American characteristic, the eagerness with which new ideas are examined and considered; the openness of these meetings to those who really have something to contribute, the presence of the older men (many grown gray in service and occupying exalted positions, ready to give freely from their wealth of experience), enabling the attendant at these meetings to return to his home and give his dear Public the benefit of that holiday; all these are unknown to the Public in the main.

It is not generally known that ours is the only profession that works against any sordid interest of its own in its attempts toward sanitation, improvement of conditions that are prejudicial to the health of the Community, and toward the prevention of disease.

Because of this lack of knowledge, for which we are largely to blame, when attacks are made against the profession as a whole, such as by the antivivisectionist, the antivaccinationist, etc., except for a very few of our more discerning friends, we are without defenders: when some vindicator of our aims arises and depicts the facts as they really are, he is subjected to angry threats and villification.

In a recent number of the Journal of the American Medical Association (Sept. 3, 1921) there is an editorial entitled "Anti-Vivisectionists attempt suppression of Truth."

It calls attention to an article by Mr. Ernest Harold Baynes in the July number of the Woman's Home Companion, entitled "The Truth About Vivisection" and the characteristic and unfair rejoinder by the President of the New York Anti-Vivisection Society over the signature of Diana Belais, its President.

A boycott is suggested against Mr. Baynes and Miss Gertrude Lane the Editor, and the Woman's Home Companion, "which will naturally have little effect."

"A public service of great value" (says the Journal of the A. M. A., July 2, 1921) "has been rendered by the author of the article, the Editor and the periodical which have had the courage to publish the facts in the face of such unprincipled opposition as was realized would be encountered."

*"To come to the support of such friends of the profession some action is needed on our part."*

I believe it entirely within the province of a powerful organization of specialists such as this Academy consists of, to heed this appeal and to propose to similar organizations of Medical men, the formation of a Committee on Medical Publicity, of the entire Profession.

This Committee would be free from any objection of self-advertising and would, by appropriate articles in the Press, rally to our support the best elements in the community. Unfair attacks such as the foregoing would be promptly refuted, and people generally would learn that we are actuated by no sinister motives, that we are not guilty of the venomous charges made against us, that we are human, and humane, devoted to our profession, working hard all our lives to keep in touch with the ever changing medical advances, that our first and greatest pride lies in the cure of disease, and that we would rather prevent a disease than treat it.

They would ascertain that we are unselfish, sincere in our efforts, downcast and unhappy with our people in the event of failure, and rejoicing with them when victory follows our ministrations.

When that full understanding comes, as well it may, many friends will rally to our support, there will be no need then to plead for the support or endowment of our Colleges, Libraries or Hospitals; we will be asked "What do you want?" And the large and generous heart of America will respond as it always has responded in the past.

There are many things such a Publicity Committee could do—one that occurs to me is to convince legislators that it is a crime to put a virulent poison like concentrated lye in the same size and kind of tin as is condensed and evaporated milk, without a conspicuous poison label. Bills to protect the community in this connection have been recently defeated; the

Barnard Bill in the Congress at Washington and the Miller Bill in the Pennsylvania Legislature.

In both instances a powerful lobby killed the bills in having them postponed until the last minute, so that they were lost in the mad scramble to rush through appropriation bills.

Dr. Chevalier Jackson of Philadelphia, our fellow member, who has had a steady stream of cases of stricture of the esophagus following the swallowing of lye in his bronchoscopic clinic says:

"Efforts at remedial legislation have met opposition from manufacturers. *It is time the influential members of the Medical Profession took the matter in hand* in such a way, that any one buying these corrosive poisons shall be warned of the dangerous nature of their contents by a label so conspicuous, as to compel attention such as the druggist is required to use in selling any kind of poison."

Our Publicity Committee, acting on behalf of the entire Medical Profession would help with such legislation and watch such tactics above referred to, they would ascertain the exact reasons of manufacturers for fighting against this reasonable provision, and if they ascertained beyond any doubt that it was objected to only because financial interests were involved, the committee could publish the names of the manufacturers in the home papers of the latter alongside the photographs of the innocent children whose lives have been sacrificed, or whose months or years of untold suffering of a most excruciating nature had been occasioned by a wanton neglect of a public duty, and solely for pelf.

It is unthinkable that a physician, actuated solely by his love for the only sincere human beings, the little children recalling their faith in him, who put their hands so trustfully in his, should stand as a mendicant before the Legislatures, asking in their name and for humanity's sake for protection to these little ones, and not have the enthusiastic support of this Committee, as of the entire medical profession.

There are many things such a Committee could do, but I leave this matter with you, for further elaboration and consideration, if you approve.

The second subject presented to you will be:

WHAT CAN WE AS SPECIALISTS DO TOWARD THE BETTERMENT OF  
HUMANITY?

As Specialists, I feel that we should give our unqualified support to the instruction of the deaf child or adult; the cor-

rection of speech defects; and what will reach every home, that proper enunciation be taught to children.

More than twenty years ago, Dr. Max Goldstein of St. Louis, presented to this Society the needs for instruction of children who were suffering from deafness, either acquired or congenital. Since then from time to time our attention has been called to the need for such instruction, and much progress has been made in this direction. Schools have been established, classes formed, and the results thus far obtained have been gratifying.

There is need for further effort. These schools need support; parents should be taught as to the advisability of early training and the entire community should be awakened to the great work that can be done by competent teachers for these handicapped children.

As an object lesson showing what intensive instruction can do, I recall a most thrilling and dramatic exhibition:

It was shortly after the close of the War. The presentation was before an annual meeting of our Throat and Ear Associations, and was arranged by courtesy of our fellow members, Dr Charles W. Richardson and Dr. John M. Ingersoll, who with their assistants had charge of the hospital for Head Surgery at Cape May.

There were present a half dozen bright young soldiers who had lost their hearing completely from injury of one kind or another.

The supervisory teacher, Miss Enfield Joiner, on being introduced, rapidly sketched the method of instruction by her assistants and herself.

Her words were closely followed and understood by the young soldiers, who watched her every expression; they were contentedly smiling, conscious of their new possession. As a background to these happy young fellows, was a bevy of no less happy and glorious specimens of American womanhood, who had served their Country faithfully and conscientiously by patiently and successfully teaching these young men under the supervision of Miss Joiner, and giving them again in a large measure, a field of usefulness and of hope.

One could not help an inward prayer that a grateful Country would never forget these noble women, and that a long, useful and happy life be granted them.

It was a glorious exhibit of what could be done under intelligent direction.

The thunderous applause that followed this most successful presentation meant to all concerned: "Well done thou good and faithful servant."

We are progressing also in our endeavors to restore the fullest and freest speech to stammerers,

"Whose nervous dread and sensitive shame freeze the current of their speech; they stand impotent of words, travailing with unborn thoughts."

Success has followed intelligent study of these unfortunates, and these endeavors should have our most cordial and enthusiastic support whenever satisfactory methods are demonstrated.

Except in a small part of our country, no attention whatever is paid to proper enunciation by growing children, and we have as a result the painfully shrill voices, improper inflection and unregulated modulation of vocal sounds.

Much attention is paid to this subject in England and in parts of our own New England.

The delight of a sweetly modulated voice enhances the personality of the owner, giving an added charm that is a joy to the giver as well as to the recipient.

In this era of progress, striving for the highest in everything, beauty in vocal sounds is no small thing; it adds materially to the joy of living and is quite as ennobling in one sex as it is in the other.

So many of you are interested directly or indirectly in educational institutions, that your influence exerted toward these improvements in speech and the minimization of the handicapped, in the loss of one of the most important of the senses, will be of exceeding value. Once more you will thus have shown again the singleness of purpose of the medical profession.

I am fully aware that these suggestions are almost entirely in the sphere of the Otologist and Laryngologist, and that there is also much to be said of the relation of the Ophthalmologist for the protection of the eyes of our people.

My omission of the latter subject is due solely to the fact that I could not speak convincingly of matters that are not in my field of work.

I trust, however, if what I have said appeals to you, that a Committee may be appointed on the President's address, representing the entire field of usefulness of this Academy, who will make such recommendations that shall carry into effect

measures which may result in more thorough knowledge of the aims of our Profession, in the betterment of conditions that we know require improvement, thus adding measureably to the welfare of the Public whose interests we have so close at heart.

## INDUSTRIAL TRAUMA IN RELATION TO THE DEVELOPMENT OF OCULAR TUBERCULOSIS, SYPHILIS AND NEOPLASM.

HANS BARKAN, M.D.

SAN FRANCISCO, CAL.

In bringing this subject before you, I have no new facts to present. The literature is large, dating back to the time of Hippocrates. Since the introduction of Workmen's Compensation Laws in Switzerland in 1875, followed by Germany in 1884, Austria 1887, Norway 1895 and in our country within recent years, clinical and experimental facts allow certain definite conclusions regarding the relation of trauma to tuberculosis, syphilis and neoplasm, and can be accepted as a working basis. In our country this matter has become of importance to us as ophthalmologists, because of our capacity as referees under the Workmen's Compensation Act. We are often required to state our opinion regarding the effect of industrial trauma on the eye, as a matter of official record before the court or the Industrial Accident Commission, and in no case do we meet with as much difficulty in forming a definite judgment for the consideration of the Accident Commission and the insurance carrier regarding the medical aspects of the case, as in those where trauma plays or seems to play a role in the production of tuberculosis, syphilis and neoplasm of the eye. Accidents occur to employees who are suffering from some existing disease or from some preexisting disability; the existing disease may be so marked that trauma plays a secondary role in its further development. On the other hand, it may be latent or incipient, and its development following trauma throws the responsibility for the development and acceleration of the disease process on the trauma. These coincident conditions present many perplexing problems to the surgeon. He must decide to what extent the accident is responsible for the disability. He must decide whether or not the preexisting condition was aggravated by the accident, or whether the injury itself was complicated or the healing deferred by the already existing condition. These problems arise with great frequency in the eye surgeon's practice, especially in the practice of those of us who are fortunate enough—and I say this with emphasis—to be called

upon frequently for industrial service and as referees. There is no part of our work which calls for greater thoughtfulness, care or keener judgment than a fair estimation of the interests and rights of the injured. A careful examination not only of the eye, but of the man, and a careful history are essentials. The compensation to be awarded, the term of compensable disability, and the general legal and moral status of the case hinge often on the surgeon's decision with reference to the disease factors mentioned. For this reason it seems to be pertinent to review shortly the status of trauma to the eye in its relation to tuberculosis, syphilis and neoplasm.

The great majority of traumatized eyes heal according to the amount of injury, and the knowledge and skill of the surgeon. A certain percentage, however, show deviations from the usual, which lead us to suspect complicating factors. These factors may be the general poor condition of the patient, some chronic disease, or a local process about the eye, such as the teeth, tonsils or sinus infections, all or any retarding healing. If the injury to the eye is of an industrial character, all complicating factors must be dealt with as part and parcel of the injury. Taking up some specific illustrative examples, let us consider how syphilis of the eye, especially as expressed in interstitial keratitis plays a role. Whether trauma can be regarded as a provocative agent in the production of an interstitial keratitis has long been a moot point, denied by some excellent authorities and as positively affirmed by others. Personally, I have seen three cases in which the trauma, its character and the time relation of the appearance of the interstitial keratitis were clear enough to establish for me, at least, that trauma as such and in a predisposed individual can stand in direct relation to the appearance of an interstitial keratitis. Igersheimer, the noted authority on syphilis and its eye manifestations, practically denies that trauma as such is a cause, admitting, of course, that there are well authenticated cases following blows, but believing that the appearance of interstitial keratitis is a pure coincidence. Statistically, we face the fact that in Breslau among 670 cases, trauma had to be considered only twice. Igersheimer in 300 cases found not a single case pointing toward trauma. It is also to be remarked that many an eye which has suffered from interstitial keratitis is injured or operated upon without consequences. Igersheimer in experimenting with rabbits injected through the blood stream, in whom luetic manifes-

tations appeared, attempted repeatedly to obtain a specific characteristic by trauma to the cornea, but without success. In spite of a good deal of negative evidence, I believe that such cases are not so infrequent. To explain the process is difficult. Some examples might be considered. We know that it is very probable that luetic toxins are in the circulation, and that in the cornea in such cases antigens and antibodies may meet and colloidal precipitation from a blow start the process. If a sufficient trauma occurs at a time when such a process is just ready to start of its own accord, we can believe that it might act as an activating agent. If now the second eye undergoes the same process a few weeks or months later, it does so independently of the injury to the first one, this first one having been in a sense artificially produced by the activating trauma. The other mode of origin may consist of direct activation of dormant spirochetæ present in the cornea. It is true that so far as I have been able to discover in the literature, only one questionable case has been demonstrated, and, in general, interstitial keratitis is not taken to be a direct spirochetal infection. Here the following might be considered. Recent bacteriologic investigations have shown that in many cases the absence of the causative organism at the time of the examination of the tissues is not uncommon. A few organisms may be activated by trauma, their toxins liberated, and thereupon the reaction of the tissues to the toxins forms the clinical picture. When weeks or months after the process the tissue is examined, there may be complete absence of organisms. Such may very well be the case in the cornea. Few eyes are lost by interstitial keratitis and these have been examined a long time after the initial process, so that it can scarcely be denied that it may not after all be a direct spirochetal infection. That trauma may play a role in activating the process cannot be denied. We have too many examples in general medicine which clearly show that trauma to the bones, joints or tissues of a patient with acquired or congenital syphilis, results in a more complex process of healing and in a stormier clinical picture than otherwise. As we are unaware of the pathogenesis of interstitial keratitis, any attempt to explain the effect of trauma is, of course, purely hypothetic. We must acknowledge in fairness to the individual its possibility as a sequence to trauma, provided the following facts are established:

1. The trauma must be positively ascertained, and must

be more than such as the individual is exposed to in the ordinary course of his employment (for instance dust, chemical fumes, wind, etc.)

2. The trauma must strike the cornea itself, and must cause a definite irritation.

3. It must be estimated by an expert that the interstitial keratitis is not present at the time of the injury, and that the consequence of the injury is an interstitial keratitis.

4. It is finally deemed by some authorities that a definite irritative condition of the eye must exist from the time of the injury to the time of the appearance of the interstitial keratitis. This, however, I do not subscribe to, and believe that if trauma can induce an interstitial keratitis, a blow on the eye not followed by a period of irritation can lead to the appearance of interstitial keratitis.

In tuberculosis of the eye following trauma, our footing is securer than in the case of syphilis. The activation of pulmonary tuberculosis by chest trauma is well known, as is tuberculosis in the bones, joints, glands and meninges following trauma. These clinical facts are supported by many clear cut experiments. It is obvious that injury per se cannot cause tuberculosis of a bone or joint or eye. The tubercle bacillus must be present. Autopsy statistics show that after the age of puberty, 98 per cent show some hidden or active tuberculosis lesion. Sufficient injury may provoke a latent process into action. This injury need not be severe, as pointed out by Wolff-Eisner. Slight injuries are not infrequently followed by tuberculosis. \* Mock in his "Industrial Medicine and Surgery" states that trivial trauma is frequently the cause of the development of tuberculosis, and in the eye we have to consider the appearance of tuberculosis following trivial injuries quite frequently. How does a tuberculous iridocyclitis, for instance, develop after trauma? The organism may already be present, inactive, and be started into activity, or the hyperemia of the iris or small capillary hemorrhages or thrombosis establish the iris as a locus minoris resistentiae. The time relation of the blow to the appearance of tuberculosis of the iris, for example, is interesting. There is no tissue of the human body where we have an opportunity to see as clearly and constantly the development of pathology as in the eye. For this reason it is not surprising that a distinct tuberculous process can be ascertained as occurring within

nine days after trauma, and be diagnosed as such. In the first two weeks after injury, an iritis can be definitely established as tuberculous only if actual tubercles appear. These I have seen as early as the seventh day after the injury. It can be presumably diagnosed as tuberculous if the trauma as such would not ordinarily be followed by iritis, and if, with or without demonstrable tuberculous lesions elsewhere, a focal reaction is obtained with tuberculin.

In discussing the relation of trauma to malignant disease of the eye, we enter upon such a huge field that it is scarcely possible to do it justice in this paper. For a most splendid chapter on the general subject of trauma and malignant disease, I would refer you to a paper in *The California State Journal of Medicine*, Vol. XIX, No. 2, page 54, on "Relation Between Trauma and Malignant Disease from an Industrial Viewpoint", by W. Ophüls. As Ophüls says: "The etiology of 'tumor' is woefully deficient." Is it due to abnormality in development or to inflammation, or is it connected with the more normal processes of hypertrophy and regeneration? "Any break in continuity, often the result of trauma, carries with it the possibility of development of true tumor." Clinically we know that repeated and continued traumatic influences are more likely to terminate in tumor than a single trauma. The instances are too numerous and well known to spend time upon. The relation of single trauma to tumors is much more doubtful, and Ophüls states that there is no case so far recorded which proves its existence with scientific accuracy, but there is sufficient evidence to make it justifiable to give the patient the benefit of the doubt. The rules have been variously formulated but there is a very good consensus of opinion on the essentials as follows:

1. The occurrence of the trauma must be proved.
2. The trauma must be severe enough to appear effective.
3. The growth must develop at a place likely to have been injured by the trauma.
4. It must be reasonably certain that the traumatized part was normal before the accident.
5. The time elapsing between the trauma and the appearance of the tumor must agree with our scientific experience in the rapidity of the development of the particular tumor under consideration. The time must not be too short, not less than a few weeks, nor too long—the outside limit is

usually given at about two years. Ophül's conclusions are that a single trauma not followed by complications is a rare cause of tumor. We find that Fuchs, in 1882, estimated that among 259 choroidal sarcomata examined, 11 per cent might have been traumatic. It may be true that the physician may not mention it frequently in his report, but the patient often states that trauma started the process. We, of course, have to take most of these statements with a grain of salt. Is it conceivable that a choroidal sarcoma may originate from a blow on the eye? Again not knowing the real origin of tumors, we cannot be positive, but to me it is perfectly feasible that a jar or blow sufficient to cause even microscopic alterations in the position of the elements of the choroid might be the starting point of such a case. There may be some slight break in continuity, some small hemorrhage or thrombosis to disarrange the cells. We have neither time nor space, nor is it the object of this paper to go into the matter of tumor origin. The time element in regard to the injury is even more important than in tuberculosis and syphilis. If we find a tumor developing a year or two after the trauma, it is not, in view of the well known rapid growth of sarcoma, very logical to attribute the tumor to the trauma. If, however, a few weeks or a few months following a well established blow on the eye we find a sarcoma developing, we can scarcely deny that there may be a relation between the trauma and the tumor.

By quoting some specific cases, I may bring out certain points in the industrial relation of trauma to syphilis, tuberculosis and neoplasm.

1. A. B. Employed in an ice producing plant. His work consisted of loading ice blocks into cars or platforms. While at this work no eye complaint. Whenever sent to bring ice blocks from dark and cold refrigerator plant out to sun porch, notices after three or four days that both eyes become inflamed and painful. This will then last for several weeks. This has occurred six times in the course of the last six years' employment, so that he is now never asked to perform this type of work. Saw him ten days after initial symptom. Marked plastic iritis; precipitates on Descemet's membrane; vitreous opacities. Tuberculin reaction highly positive with focal reaction. Fibrosis both apices.

2. E. H. Delivery boy unloading card boxes filled with

envelopes from automobile. Three boxes weighing approximately 15 pounds fell from height of three feet. Struck left upper lid. Ecchymosis of lid, subconjunctival hemorrhage. No corneal lesion. Vision normal. Nine days after, stated that for last two days the eye had been extremely tender, and that he had almost complete loss of vision. Iris discolored. Eleven small tubercles and three as large as pin heads. Both upper lobes extensive tuberculous process. Enucleation due to rapid intraocular extension of process, with secondary glaucoma.

3. F. M. Boy, struck by piece of rock on eye. Hemorrhage subconjunctival. Sluggish iritis, lasting for three weeks, developed two days after blow and then died down. Very marked focal reaction with tuberculin. History of cough, sputum filled with tubercle bacilli, marked active tuberculosis both lungs.

In all of these three cases the process was called the direct result of the injury and full compensation awarded.

4. Washerwoman, age 32. In wringing out bath towel, struck right cornea rather forcibly. Seen that day. Epithelial abrasion. Marked photophobia and lacrimation. Symptoms vanished under treatment in three days. Ten days later she appeared with a beginning vascular type of interstitial keratitis, which ran a typical course. Seen for three weeks, and then did not return, so cannot state fate of second eye. Hutchinson's teeth and quite deaf. Wassermann triple plus.

5. Expressman, struck on left eye by trunk strap very forcibly. Iridodialysis. Subconjunctival hemorrhage. Hyphema. Usual treatment. Three weeks afterwards, rapidly developing, typical interstitial keratitis. No congenital stigmata. Wassermann +++. Family history negative. Three healthy brothers. Two healthy sisters. Venereal history denied. Five weeks afterwards the right eye started a similar process.

6. A. J. Bookkeeper in bank, age 62. Ledger, weight approximately two pounds, fell from shelf three feet above. Hit him as he was looking up, striking his left upper lid forcibly. Seen three weeks after injury. Stated, as was confirmed by local eye specialist, that his eye was only slightly bruised and vision normal. Two disc diameters from disc temporally, and three papillae diameter in size, elevated 4 D., a bluish mass diagnosed as sarcoma of the choroid. Tension normal. Vision 5/10. Enucleation. Pathologic diagnosis—melanosarcoma of choroid.

7. O. E. Lumberjack in mill. Revolving leather belt caught him and threw him. Struck head. Unconscious for ten minutes. Resumed work an hour later. Same day noted, and stated to one of the other workmen, that he saw nothing with his right eye. Large melanosarcoma. Tension +1. Seen three weeks after injury. Enucleation. Pathologic diagnosis confirms. This man was in good health four years afterwards.

8. Dr. O. C. Ship surgeon. Swinging rope struck right eye. States that he knows the eye was normal afterwards, as he made some microscopic examinations a few days after the trauma. Seen three weeks after trauma with mass, chocolate color, in macula. Elevation 4 D. Vision; counts fingers at six feet. No tension. Enucleation. Pathologic diagnosis—melanosarcoma choroid.

In the tuberculous cases quoted, it seems quite clear that from the industrial as well as medical standpoint, the trauma was the direct exciting cause of the tuberculous lesion.

With reference to the syphilitic cases, there may be some doubt as to the relationship. The blow may only have been incidental, and interstitial keratitis might have developed at any time without trauma. When, however, the time interval is so definite in its relation to the trauma as it is in these cases, I believe it hard to assert that the injury has not had a very decided influence in bringing on the attack at that particular time, at the very least.

In the tumor cases, the first and last ones are susceptible of an industrial interpretation. From the medical standpoint, there has been sufficient trauma and there has not been too short an interval before the appearance of the growth. Both men were intelligent and noted their symptoms promptly, and one case stated that his vision was normal after the blow and this was confirmed by his attending oculist. This, of course, does not mean, as the fundus was not examined, that the man might not have had a beginning tumor at that time, but even if in both of these cases there was a beginning tumor, the question arises, especially from the industrial standpoint, as to whether the growth of that tumor could not have been accelerated by the blow. To that question if asked us by the referee, we can only say "Yes" although of course, we will qualify this by stating that in any event, the tumor would sooner or later, without the blow, have reached its maximum effect. Both of these men, are, however, I believe, justly compensable.

The second case—that of the lumberjack struck by the belt—is quite clearly not a compensable case. The man had a tumor out of all proportions to what is possible in the length of time from the injury to the time of the observation. These cases will always claim compensation, and we must be positive in our statement to the referee or court that there can be no relationship. We are called upon only to express our medical judgment, and it is left to the Accident Commission or court to determine the compensability of the case. In this compensability many factors play a role—the nature of the employment, preexisting physical ailments, time relations of effect and cause, questions of negligence, wilful disobedience, absence of common safety devices, etc. It is, however, not a bad idea for those engaged in some amount of industrial surgery to familiarize themselves a little with the broad point of view held by most Accident Commissions—a point of view I know held by the Accident Commission of the State of California. If we report that there is a likelihood of relationship between the eye injury and later development of tuberculosis, syphilis or neoplasm, other factors being equal, it will be decided in the sense that the injury was the direct cause of the disability, and the patient compensated accordingly. If we decide that a latent or slight active process in the eye was accelerated or caused to appear active before it otherwise would have done so, compensation is awarded accordingly. If we are absolutely positive that the injury sustained could not in any way have caused the later appearance of tuberculosis, syphilis or neoplasm, we must state so. We must state so without equivocation, for it is only then that the employer or insurance carrier is given an equal consideration with the employee. The view point is that ordinarily an employer must compensate his injured employee for the entire disability caused by accident, regardless of the effect of poor physical condition of such employee aggravating or complicating the condition. An employer must take his employees as he finds them. An exception to this has been made by the Commission of the State of California, however, in 1915. In cases where the duration of the process is unduly prolonged by syphilis, tuberculosis or chronic varicose ulcers, compensation will be awarded only for the longest period of disability for which a normal person sustaining the same accident would reasonably be disabled. The above seems quite just,

for there must be some limit where the greater part of the disability is due to the disease and not to the accident.

As stated in the beginning, I have presented no new facts. But occasionally it seems fit to add new fuel to old fire, so that the flare catches our eye, stirring our memories, stimulating us to study in the light of rekindled faggots.

## VOCATIONAL, OCCUPATIONAL OR INDUSTRIAL DISEASES OF THE EAR, NOSE AND THROAT.

JOHN A. DONOVAN, M.D., F. A. C. S.

BUTTE, MONT.

A correspondence with one or more otologists in each locality in North America shows that a few of our profession overemphasize this subject, while many more have hardly given it a thought. The recent war, as well as the increasing clamor for state medicine, makes it imperative that we consider it carefully. A general knowledge will also assist us in making a correct diagnosis in many an obscure case, especially in patients consulting us from other industrial localities. Besides one or two friends in each city, who have assisted me, to whom I express thanks, I have quoted liberally from H. V. Würdemann, also from Kober-Hanson, and Barrett and Shaw's work on "Occupational and Vocational Diseases."

Though it may appear that all the diseases enumerated here are due to a vocation, such is far from the intention, for, except in those few very obvious special cases, the vast majority would not have resulted except for a very fertile soil being already supplied, such as diseased tonsils, adenoids, deflected septum, hypertrophied turbinates, or other abnormalities of tissue. Any of these conditions should always immediately receive special attention when the person contemplates a vocation which is likely to aggravate the condition, though no serious symptom is then manifest.

Not knowing a better method, I shall ask your kind indulgence first in considering general conditions and specific elements causing diseases, together with the symptoms of each, then, under vocations, I will simply refer to these causes again to save your time. With few exceptions, no symptoms, except those to which this title refers, will be mentioned, the other general symptoms being assumed.

CAUSES: (1) *Altitude*. In first visiting high altitudes, most people experience a fullness in the head, a feeling of dyspnea, head throbbing with heart beats, nose bleed, nasal turgescence, irritation and dryness of the throat, fullness (really a vacuum) in the ears, tinnitus, decreased hearing (really due

to the closure of the tubes, and immediately relieved by inflation), and dryness of all mucous membranes. High altitudes are naturally very dry. Exercise, especially climbing, increases all symptoms. All these usually disappear in from a few hours to a few weeks sojourn. A very rapid ascent to a high altitude intensifies all these symptoms. Besides, there may be severe hemorrhage from the nose, gums, and even the ears, with labyrinth and semicircular canal involvement, dizziness, nausea, and even complete unconsciousness. This latter condition is more likely produced by a too rapid descent, and results fatally for the aviator, (the cause of a number of fatalities).

Of course, cloud moisture, alternating with extreme dryness, and intense cold, accompany extreme elevations. Fortunately people soon become accustomed to these minor changes, and do not notice them. For example, in Butte, where thousands of men descend and ascend three thousand feet, or even four thousand feet, in the mines in a few minutes' time, I do not recall any miner ever mentioning this factor, while a stranger is fully conscious of a change. Of course the heat would be great at these lower levels, except for the constant supply of forced air.

Caisson disease is in this classification. Men work in highly compressed air containers. Probably there is an excess of oxygen, and possibly injurious gases, dissolved under pressure in the blood; and if the air is allowed to escape too rapidly from the caisson, these gases in the blood are released into the tissues: or it may be toxic or carbon dioxide: or again it may simply be from the sudden release of pressure. The results are: epistaxis (very common), ruptured drum membranes, tinnitus, nausea, giddiness, loss of power in limbs, and unconsciousness.

Asthma, hay fever, and similar conditions, are usually relieved, and very frequently permanently disappear in high, dry altitudes. Hypertrophies, turgescence, tinnitus, etc., are probably made worse, but often the dryness improves them. Mucous discharges are lessened. Inversely, these chronic turgent rhinitides with ear complications, or dry or atrophic conditions, improve immediately on going to low moist altitudes. I have had many patients with chronic discharging sinuses or ears report immediate relief on going lower, while a few became worse by the change. We are about five

thousand eight hundred feet elevation, dry, and never very hot. Contrary to the general opinion, a descending barometer is not the cause, in itself, of rheumatic conditions, as otherwise elevation would increase it also, which is not the case.

(2) *Winds and Drafts.* Fast motorists, all speed fiends, and those living or working in high winds or drafts suffer from irritation of the nose and throat, with all the ear complications. A direct hard wind into the ear causes myringitis, otitis, and in time, chronic disturbances with deafness.

(3) *Temperature.* Constant extreme cold or heat do not affect like sudden changes. The extreme cold of the North Pole did not give Perry's men any colds, but opening a bundle of carpets, also cleaning house, immediately produced severe coryza in all hands. The modern girl, or rather her modern clothing, or lack of it, will not produce nearly the coryzas, rhinitis, laryngitis and ear complications from which her more or less fortunate sisters cooped up in overheated apartments will suffer. The overheated offices, theaters and pullman cars, in which the long suffering public is at the mercy of a janitor or colored porter, cause innumerable catarrhal conditions, and are the origin of too many fatalities resulting therefrom. It is the excessive heat, relieved by sudden cold drafts, or vice versa, that causes the trouble. Of course local irritations, dermatitis, perichondritis and effusions in the external ear, frost bites and gangrene of the ear result from extreme exposures.

Many a case of chronic laryngitis will soon disappear by sojourning outdoors. Living in a tent in the woods in winter is my favorite prescription for myself.

(4) *Humidity,* according to Collis and Greenwood. Though in dry changing air one may work at a temperature of 135°F. without any immediate harmful results, in humidity, when the temperature as measured by the wet bulb thermometer reaches 78° F., the danger point is reached for carrying on active work. Body temperature is regulated principally by skin radiation, conduction and evaporation, which is prevented by warm humid atmosphere. The maximum efficiency seems to be obtained in a relatively dry atmosphere at 65°F., while after a day's labor inside a humid temperature of 70°F., the worker has no energy left, and has no desire for food.

In dry places, mucous membranes dry, and discharges

diminish or cease. In dampness, mucous discharges become excessive. Rheumatism, and its sore throats, are common. Pharyngitis, tonsillitis and laryngitis are common in those working in wet places, also mycosis of the external ear canal, and chronic congestion of all mucous membranes (these of course are aggravated by the sudden cooling at the close of day).

(5) *Dust*, except when fully exposed to sunlight and fresh air, usually contains infectious matter, which is the cause of a great many of the infectious diseases of the respiratory organs, with the usual ear complications. Mechanically, there is a constant irritation of all the mucous membranes. The anterior part of the septum is irritated and bleeds easily, and there are small ulcerations and perforations. The posterior septum is swollen and dust covered. Ultimately there are hypertrophies of the posterior, especially the upper portion of the septum, the middle, and then the lower turbinates, functional collapse of the nasal tissue, loss of smell, taste, etc., dry feeling in the throat, engorgement of the large vessels, dusty mucous glaring pharynx and many small hypertrophies; later, loss of sensation and atrophy. The larynx shows similar reaction; ear complications as usual.

Most varieties of dust, ordinary dirt, smoke, coal dust, etc., will be coughed up and expectorated, so, if not exposed too long, will give but temporary symptoms. Every person with a deflected septum is an easy victim to dust irritation. Hard rock dust, included under the general term silica, remains permanently in the lungs, producing a fibrous condition known as fibroid phthisis or silicosis or pneumoconiosis, in popular parlance, "Miners' Con." With the exception of the constant use of water sprayed on the rock while working, nothing will prevent this most serious malady. The underground miner cannot wear a mask at all comfortably, but the man outdoors might. In fact, it is at present his only salvation. Butte's three thousand miles of underground tunnels are kept habitable and cooled by an abundant supply of fresh air and cold water, operating through the compressed air drills. Fresh air is blown into the mine through large canvas tubes. The former method, that is, the use of compressed air, carried too much moisture. Of course there is still some dust, and considerable heat and moisture, so we do not recommend deep mines as an ideal health resort. Though in some

mines chronic laryngitis is common, in ours it is extremely rare proportionately.

Dust causes hay fever and asthma in many, especially when loaded with organic matter from sweepings, such as flour, horse dust, and the pollen of many plants, etc., but again, there is most likely to be a deflected septum and enlarged turbinates, adenoids or tonsils, making an ideal field for trouble.

Ankylostomiasis in miners does not appear to exist in America. It is a trematode worm disease with anemia and edema.

(6) *Chemical Irritants.* Arsenic dust is a very frequent cause of a low anterior septum perforation, and often occurs without noticeable symptoms. It does not extend to the bony septum, or high up. Aside from this, acne of the face, nose and ears (arsenic pox), boils, ulcers, nausea, vomiting. Severe coryza, dry sore throat and hoarseness frequently result from living in rooms with arsenic colored wall paper. This arsenic dust appears to result from bacterial action originating in the adhesive paste. Middle ear and auditory nerve affections may occur.

Anilin. Local ulcers of the skin and mucous membranes, with dermatitis.

Carbon. Chimney dust, smoke, tar, pitch, etc. are local irritants, coryza and not infrequently cancer resulting.

Carbon bisulphid. Peripheral neuritis, bilateral paralysis.

Carbon monoxid, dioxid. Diminished power of speech and hearing, dizziness, extreme headache, aggravated by exertion.

Chrome and bichromates. Eczema and erosions, skin ulcers with thick undermined edges. It attacks the nasal septum similarly to arsenic, rapid perforation resulting.

Cement, lime, salt, soda and potash are very irritating to the septum, causing small ulcers, hemorrhages and perforations.

Gasoline, benzol and naptha cause irritation, with slow necrosis, etc.

Iodin is a nose and throat irritant, causing tinnitus and double hearing.

Fumes and gases of both acids and alkalies, and many other substances, are extremely irritating to all mucous membrane, many being very toxic, with symptoms accordingly.

**Lead.** Blue line on gums, pale face, headaches, simulating brain tumor, tongue and lip tremors, interrupted speech, laryngeal muscle paralysis, tinnitus, auditory paralysis and double wrist drop. Lead poisoning occurs in upwards of one hundred and ten industries.

**Manganese.** Impulsive laughter, mental changes, monotonous voice.

**Mercury.** Pale face, sore painful mouth, bleeding gums, profuse salivation, difficult swallowing, yellow ulcers, foul odors, in chronic cases a peculiar copper color in the mouth and trachea, constriction of the esophagus, labyrinth deafness, auditory paralysis, and necrosis of the bone.

**Phosphorous.** Skin palor, intense pain in the lower gums, necrosis of the lower jaw (phosy jaw), pus, large glands, necrosis of the septum, and possibly the ear bones also.

**Platinum Dust.** Coryza, sneezing, hay fever from which those exposed can get no relief while vocation continues.

**Zinc.** Quite similar to arsenic.

(7) *Explosives.* In a paper, "Blasting Eye Injuries," read before the Section of Ophthalmology, A. M. A. 1905, I pointed out that gunpowder has a rending effect, while high explosives have a shattering effect. Much surprise has been expressed at the numerous ear troubles following the late war, when none occurred in earlier wars. The substitution for black powder of nitroglycerin, fulminates, trinitrat of tulol, etc., is the explanation. Though a detached retina but very rarely, if ever, occurs from gunpowder explosion, and not frequently from dynamite, when a box of fulminate, detonating caps, explodes accidentally, my observation of the patients who were in close proximity, is that detachment is the rule. Thus by analogy the severe ear complications are readily understood.

A shot from an ordinary sporting rifle, gun or pistol, if near the head, produces a concussion in the ears, irritation and tinnitus. I have found that hot douches of considerable water will readily relieve this. The ears should be protected with paraffined cotton plugs, or something similar. If the concussion from big guns or blasts is severe, and the membrane ruptures, it follows the long head of the malleus. If infection follows, then suppurative otitis results, with its usual complications. If the shock is severe and rupture fails to occur, the shock is transmitted to the internal ear, with

possibly small labyrinth hemorrhages, symptoms of tinnitus, and decreased or lost hearing. The high and low scales are markedly diminished, while the middle scale may remain normal. Fortunately, most cases practically recover. When they do not, degeneration takes place in the organ of Corti and the labyrinth, with possibly eighth nerve involvement. Of course severe shell shock, a process complex, may produce central trouble causing deafness. The semicircular canals are involved, with loss of equilibrium, dizziness, etc. Hysteria may be the cause with a certain class of patients. Malinger-ing is not under discussion here. With riflemen, and shooters in general, a mild catarrhal otitis media is much aggravated, in fact it is a forerunner of many of the symptoms brought on by exposure to these blasts. Nitroglycerin headaches result from its explosion in confined spaces in mines, etc.

(8) *Noise*. Here we differ widely and your criticism is especially invited. To economize time, I shall be dogmatic, and simply express my own conclusions after studying many diverse opinions. The constant irritating noises that drive one mad belong to the field of the neurologist, but do of course consume much valuable mental energy. Noises of high pitch, when constant, especially within small inclosures, or within close proximity, do produce deafness. This is transmitted directly through the sound conducting mechanism, and not otherwise, and can be prevented by protecting the ears directly from the noises. There is a destruction of the organ of Corti in severe cases, beginning in the nucleated cells, to the neuron, then to the vibrating mechanism and membranous labyrinth. The canals may become involved, vertigo resulting. Within buildings, hair felt covers and felt partitions reduce the noise very much. Something should be worn in the external ear canal also. Here again those afflicted with mild catarrhal tubes are the first to suffer.

I believe that deafness from explosions is due directly to concussion, and not to noises.

(9) *Fatigue*. Fatigue lessens tonicity and resistance of the mucous membranes in the nose and throat, with resulting engorgement. It also decreases the power of smell, speech and hearing. Disinclination to work, or aversion to work, brings on fatigue much faster than real labor. Poor hygienic conditions, bad light, bad air, and most of the aforementioned abnormal conditions, produce fatigue more rapidly than well

ventilated, well lighted surroundings. A vacation, or temporary change of vocation, lessens fatigue, and produces general relaxation from strain, and is a direct invigorator. In other words, take a vacation out of doors while yet you may, for the time comes soon when you will not be able to say where you will go next. Join the Boy Scouts on their camping trips.

(10) *Vocations.* Alcoholics, a common vocation of the past ages. Engorged nasal and pharyngeal mucous membranes, which in time become chronic. All abnormalities of the nose, throat, and ears are made worse. A characteristic unsteady voice.

Authors. See office workers.

Auto drivers, exposed to drafts, nose, throat and ears, dust and gas, with the advantage of much fresh air.

Attorneys. See singers, and office workers.

Anilin dye workers. Dermatitis and ulcers.

Aviators. See altitude. In addition they have exposure to high winds and cold, also to the intense constant motor noises, with resulting deafness, if not protected.

Athletes. Septum hematoma, broken septum, ruptured drums, perichondritis (prize fighter's ear).

Artificial flower makers. See arsenic, and office workers.

Band instrument makers. See soldering.

Balloonists. See aviators.

Boilermakers' deafness. See noises.

Blacksmiths with deafness, very rare, except in close inclosures, or where many are working together.

Brass foundries' ague, headaches. See zinc.

Brass and copper workers. Green line on gums. See zinc, and noises.

Button, horn and shell workers. Dust very heavy, nose bleed, etc.

Brewers. Tuberculosis. See alcohol, and humidity.

Blanket storing. Brimstone fumes very irritating.

Blasting. Powder headaches, deafness. See explosions.

Battery makers. See lead.

Bakers, confectioners, pastry cooks. Of their total deaths, one-third are due to diseases of the air passages and lungs. See dust and temperature.

Chauffeurs. See auto, and carbon monoxid gas.

Cotton mills. See textile.

Coppersmiths. See noises and brass.

Cooks. Atrophy of taste and smell. See bakers.

Clergyman. Sore throats. See singers, and office.

Color factory workers. See arsenic, soda, potash under cement.

Chimney sweeps. See carbon dust. Cancer.

Canning factories. See humidity, wet and acid fumes from soldering.

Celluloid makers. Fumes from solvents, acetone, amyl acetate, alcohol, ether and acids.

Chemists. See all chemical poisons and fumes, also office.

Cement and concrete workers. See cement and dust.

Chrome workers. See chrome poisoning.

Caisson workers. See altitude and humidity.

Divers and swimmers. Rupture of the tympanic membrane, acute infection of the middle ear from water entering the middle ear through the eustachian tubes, due to improper breathing.

Dyers. Soda, potash. See calcium, aniline, lead and arsenic.

Dentists. See office workers.

Electric generators. Deafness from noise resulting from improperly installed motor coolers.

Elevator boys. See temperature and drafts.

Explosive factory workers. Powder (nitroglycerin) headaches. See carbon monoxide, and celluloid makers.

Engineers. See locomotive.

Farmers. See dust, temperature, and humidity. See stockmen, tetanus. Foreign bodies, foxtail, chaff and burrs in the external ear canal often remain a long time before they are noticed.

Fur pellers. Anthrax.

Flax dressing. Silicosis. See dust.

Flour millers. See dust, and noises. (Millers' asthma.)

Fishermen. Dampness and cold. See temperature, and humidity. Case of lymphoid growth in the tongue and epiglottis reported by Dr. C. H. Baker.

Fireworks makers. Argiria from breathing silver dust.

Garage workers. See chauffeurs.

Gas works. Carbon monoxide poisoning, and dust.

Glass blowers' mouth. Swelling from the angle of the mouth to below the ears and parotid glands. Thick patches of mucous membrane on the cheeks, tuberculosis from excessive heat. Syphilis from exchange of blowing tools.

Dictaphone. Hal. Foster reports deafness. See telephone.  
Gold milling. See dust, fumes, chlorin, cyanid, and mercury.

Galvanizing. See arsenic, also mercury, and zinc.

Gannister miners and workers. See stone cutters.

Hat felt makers. See mercury.

Horsemen. See stockmen, also athletes.

Indoor workers. See dust, and noises.

Janitors. Hay fever. See dust.

Jute factory workers. Tetanus.

Lime workers, plasterers, etc. See cement.

Lead products mfg. See lead.

Leather workers. See tanners.

Lawyers. See office, and singers.

Locomotive engineers. These have heretofore been erroneously placed with boilermakers. All authors, and most of my correspondents so classified them. For many years I have taken care of all Northern Pacific employes operating trains across the Rocky Mountains; also the employes of the B. A. & P. R. R., the first electrified steam railroad. The mountain division is the hardest and most noisy portion of any railroad, even rear coach passengers can hear the puffing locomotives, yet I have never treated a train man for deafness that I could positively directly attribute either to the noise or vibrations.

President H. B. Smith and Secretary W. A. Laidlaw, of the Northern Pacific Beneficiary Association, report to me that a hurried search through several years' records confirms my observations. Through the courtesy of Mr. F. V. Whiting, attorney of their Claim Department, I was put in communication with chief surgeons of the New York Central Systems, and the results reported were practically the same. A German authority reports that only 8% of their locomotive engineers have normal hearing. If this is correct, then the protection given to their engine drivers must be of the medieval type. Trainman on modern equipped American roads are of course somewhat, though not excessively, exposed to conditions producing catarrh, but not to noise or concussion deafness. I am excluding boiler factories of course. I have seen one case of deafness in an engineer who was very close to the whistle when some one pulled it; also one case of deafness from a boiler explosion.

Match makers. See phosphorous.

Match, safety. See chromates, and phosphorous.

Mirror makers. See mercury.

Manufacturers of scientific instruments. See mercury, and chemicals.

Mechanics. See locomotive engineers, noises, and dust.

Millers. See dust, noise, and millers' asthma.

Miners. See dust, humidity, temperature, altitude, and explosions. Job, Chapter XXVIII, is the first miner's text book written.

Miners' nystagmus is not an ear, but an eye complication.

Mountaineers. See altitude. The high dry air filled with ozone and a superabundance of ultraviolet rays, stimulating and invigorating, is the salvation of thousands of catarrhal, emaciated, overworked people who can occasionally avail themselves of its advantages.

Musical instrument makers. See makers of band instruments.

Office and indoor workers. Professional, clerical, clerks, factory girls, needleworkers, seamstresses. I believe this class supplies the head specialist his greatest number of patients, notwithstanding the fact that the authors have given it scant attention. G. W. Spohn in his letter feared he would be considered freakish for placing this occupation as the most hazardous in this special classification. I agree with him. A lack of outdoor physical exercise, poor air, overheated drafty rooms, frequently filled with tobacco smoke, inappropriate diet, an excess of sweets and pastry, poor digestion, and inactive bowels are all extremely conducive to edematous sluggish mucous membranes, with a lack of tonicity, insufficient muscular strength in the pharynx, larynx, and even within the ears. Catarrhal affections of the nose, throat, and ears are the rule rather than the exception. When occasionally exposed to unusual atmospheric conditions, acute catarrhal inflammations immediately result, with tuberculosis, etc. following. Early appropriate treatment of nasal deformities, adenoids, tonsils and teeth will prevent the vast majority of these conditions.

Printers. Auditory nerve deafness, tuberculosis. See lead, and vapors.

Plasterers. See cement.

Public speakers. See singers, and office.

Pregnancy with some is accompanied by irritation and turgescence of the tubercles of the septum (the genital area in the nose), paresthesia, and hyperesthesia of voice, smell and hearing.

Prize fighters' ears. See athletes.

Painters. See lead, arsenic, and zinc.

Potters. See dust, silicosis, and lead.

Physicians. See office. Liable to acute and chronic infections of the nose and throat, with sinus disease. Obstetricians, urologists, and laryngologists exposed to syphilitic and tubercular infections, and Vincent's angina.

Power plants. See electric generators.

Porcelain workers. See chrome, and lead.

Photographers. See office, soda, potash, and chromes. Platinum dust from papers causes coryza and hay fever, sometimes very serious.

Powder makers. See explosions, gases, and dust.

Rubber manufacturers. See carbon bisulphid, and lead.

Rag grinders. See dust. Shoddy fever, severe irritation of all mucous membranes, with headaches.

Refrigerator and ice cream works. Chronic congestion (cold and moisture).

Syphilis. It is a disease affecting all vocations and avocations, but possibly more prevalent with those who are in close contact with the larger mass of the travelling public, society satellites, indoor sports, certain classes of rooming house, hotel and restaurant employes, physicians, especially obstetricians and urologists, nurses, and wet nurses. My brief observation of the northern Indians was that they are extremely susceptible; in fact it is very fatal amongst their younger women. Our present government regulations are a great help, and, when efficiently administered, may ultimately eliminate it. Contrary to the prevalent opinion, the laryngologist sees the most cases; especially is this so with women patients. Acute pharyngitis, chronic laryngitis, soft, soggy nasal growths easily broken down, perforations destroying the bone, with depression of the nose (not so with dust or chemical ulcers), laryngeal growths, loss of voice, deafness, cerebral troubles, etc., deep dirty grayish diphtheritic appearing ulcers of pharynx, tonsils, palate and larynx, emitting a dirty dog odor, very characteristic, and when learned is almost a positive diagnostic symptom.

Stockmen. See farmers. Glanders, actinomycosis, anthrax, tetanus, foot and mouth disease ("aphtha fever"), vesicles and ulcers on the tongue, lips and pharynx, (a long list of catalogued diseases officially designated, which very rarely happen), but foxtail beards (something like barley), burs, etc., carried by the wind, frequently lodge in the ear canals, and sooner or later inflammation sets in. Though very frequently exposed to much wet, cold, and severe high winds, etc., (excepting those with marked nasopharyngeal abnormalities and diseased teeth) they are singularly free of disease. A good diet of a reasonable allowance of that most nutritious, easily digested, stimulating food, good beef with vegetables, seems to build an immunity against the diseases we are here considering.

Seamstresses, needleworkers and dressmakers. See office. They seem especially prone to deafness.

Sheep tenders. See stockmen, and arsenic from sheep dip.

Soldiers. See explosives, and syphilis.

Sailors. Mal de mer, an abnormal condition of the superior semicircular canals. See syphilis.

Slaughter house. Dampness, glanders, tetanus, actinomycosis, rheumatic throat, etc.

Subway workers. Carbon dioxid, iron dust, silicosis, drafts, temperature, and moisture.

Swimmers. See divers.

Soldering. Fumes of acid produce intense pharyngitis, not infrequently becoming very serious.

Shoemaking and staining. Dust, anilin, lead, tuberculosis.

Sugar factories. The lymphatics from microorganisms, bone black dust, offensive fumes, catarrh.

Salt workers. See calcium.

Smelter men. Arsenic, chlorin, bichromates, mercury, dust and chemicals.

Stone cutters. First in the list of vocations in percentage of tuberculosis mortality; silicosis, chronic diseases of all air passages and ears, followed by atrophy and laryngitis, etc.

Singers and speakers. Singers' cramp from fatigue in attempting to use the voice at too high a pitch, or too great a range. Singing should not be done over one hour (two hours at the most) a day, and never over fifteen minutes (twenty minutes the extreme) at one time. There should be at least six weeks' vacation each year, with no practice. Walking

outdoors several miles a day is an ideal exercise, and is absolutely necessary. Coughing to clear the throat when starting to sing induces hoarseness. Wear light woolen underwear in cold weather, no neck wrappings. No smoke, no dust.

Vocal nodules from excess or misuse of the voice. Laryngeal irritation affects the timbre of the voice. Too rapid training affects solidity. Vocal excesses diminish the compass. An emaciated condition, tuberculosis, etc., reduces the agility, also the intensity. Chest disorders reduce the medium scale. Catarrhal conditions, bad tonsils and adenoids, diminish the clearness. Nasal abnormalities diminish the resonance. Neuropathic temperaments produce the nervous voice.

Speech fatigues more than singing. Public speakers should acquire and maintain a standard pitch, within the medium tones, which does not produce fatigue. Start speaking with the voice where it is, and allow it to gradually reach its proper acquired standard intensity. Chronic pharyngitis and clergymen's throat, also laryngitis, results from the neglect of the above rules. See office.

Trainmen. See locomotives, and drafts.

Tunnels. See miners, caissons, and subways.

Travellers. See heat, pullman, and syphilis.

Theaters. See heat, and atmosphere.

Tea, tobacco, spice and perfume testers. Nicotin, their poisoning and atrophy.

Tobacco. Tobacco factory workers rank second in tubercular deaths from tobacco dust in the throat. Smoke aggravates catarrhal conditions, and tinnitus is intensified. Cancer of the lip, syphilis from exchanging pipes.

Teachers. See office. Much catarrhal inflammation, chalk dust, irregular temperature of rooms, loud talking, laryngitis and secondary ear diseases.

Telephone. Operators in the Bell, and all other phones of low voltage, appear to have no more ear trouble than any other office workers (contrary to all text book authorities). High tension currents, acoustic bangs, ringing bell with the receiver in the ear, especially so in the higher voltage systems, does cause annoyance, and does irritate a sensitive ear considerably, but ordinary conversation does not. I saw one man who lost the hearing in one ear completely by

lightning striking a wire. Proper fusing would have prevented this. Dr. C. B. Lyman, and Dr. E. W. Collins, of the Rocky Mountain Bell System, report no serious trouble at all with any operators, but report complaints to be in direct proportion to the user's mental attitude toward the company.

Tanning, leather workers, taxidermists and furriers. Asthma, anthrax, chrome, lead, arsenic, mercury, and dust.

Textile workers. See dust, and noises. Dry throats, cereum plugs in the ears, mycosis of the ear canals.

Upholsterers and mattress workers. Erysipelas, and infections from old rags and dust. See textile.

Wool sorters' disease. See anthrax, and mycosis of the ear canals.

Wall paper. See arsenic.

Wood polishers. See chrome, and dust.

Wheel polishers and grinders. See silicosis. Stone cutters.

Washerwomen. Infections, syphilis, chemicals (lead and mercury) from clothing of workers. Catarrhal conditions from temperature and moisture, mycosis of the ear canals.

Weavers and spinners. Mycosis of the ear canals.

A very formidable list, notwithstanding the Irishman's conclusions that after all nearly everybody dies in bed.

## INDUSTRIAL OPHTHALMOLOGY.

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CHESTER, PA.

The work of the ophthalmologist in the industrial field is both very large and quite varied. In every center of busy industries, where it is the custom to conduct a physical examination of all applicants for employment, the work of the ophthalmologist begins before the individual is employed, when he fails to pass the visual requirements exacted and immediately seeks help. In the majority of cases, the correction of a refractive error by a properly fitted pair of glasses is sufficient to permit his securing employment.

The center of industrial activity from which the statements and deductions of this paper are drawn is quite a varied one. Our industries comprise: shipbuilding plants, steel casting companies, textile mills, machine shops, rolling mills, chemical, acid and anilin plants, ammunition plants, artificial silk mills, open hearth and blast furnaces, iron foundries, drop forge works, oil refineries, congoleum, brazing, white metal, and locomotive works.

The enactment of compensation laws has made the employer more careful in the selection of his forces, because a partial disability, which in itself is not sufficient to be disqualifying, when aggravated by a minor injury becomes a permanent compensable disability. Not all who pass the employment examination are qualified; many resort to tricks and subterfuges to cover a defect which they know is disqualifying. I recall an instance of a boiler maker with an old quiescent iritis in the right eye, vision above the passing mark, who received an injury by being struck in his eye with a small piece of scale, which ulcerated and set up a violent iritis with resultant cataract, his compensation in this case being for the full loss of the eye.

The old practice of hiring a man and simply telling him to go to work and get busy has given way to more modern methods. Nowadays the workman is assigned to a leader or foreman to be instructed. It is also advisable that he be given the following INSTRUCTIONS:

1. Warned of the danger to his eyes in his work, and supplied with the proper protecting devices, if necessary.

2. He should be shown the location of the First Aid Hospital.

3. He should be instructed that immediately following an injury to his eyes, he should proceed at once to the First Aid Hospital for treatment.

4. He should understand that he is breaking the rules if he touches a fellow employee's eyes, or if he allows any one other than those at the First Aid to touch his eyes, in the endeavor to remove therefrom a foreign particle.

Almost every establishment of the past had one or more men in its employ with a local reputation for skill and dexterity in the removal of ocular foreign bodies. Asepsis to them meant nothing, their weapon being usually a pen knife, match stick, toothpick, handkerchief or lead pencil, moistened with saliva for sanitary (?) purposes. These practices in the past have cost many eyes. That they may be prevented from ruining any more is the hope and endeavor of the ophthalmologist. A great many accidents are due to carelessness on the part of one's fellow employees, this necessitating education along the line of safety to others as well as self, well exemplified by the application of the Golden Rule: "Do unto others as you would have others do unto you."

PREVENTION. The Safety committee is an organization which should be an active and influential factor in every plant. It can be of the greatest help in putting across propaganda for the prevention of accidents, and instruction in the use of safety appliances. The most important device in safety protection with which we are concerned is undoubtedly goggles. The ideal goggle has yet to be developed. As a whole, we are most of us willing to take chances, so as we walk through a plant the workman will be seen wearing his goggles on his hat or around his neck. Show the men if you will hundreds of pairs of broken goggles that undoubtedly have saved eyes from severe damage and complete loss. Then ask the next patient how he got the foreign body in his eye. The answers as to why goggles were not covering his eye can be grouped under the following headings in the order of frequency.

1. Steamed up, or wet with perspiration, and he could not see through them.

2. He had finished and removed them, when a foreign body came from a fellow workman's tools.

3. In a dangerous place, afraid to wear goggles on account of limitation of vision and fear of tripping and falling.

4. Piece workers are unable to get production, claiming that goggles slow them down.

The safety department of one plant designed shields and insisted on screening the flare of the electric welding arc to protect the surrounding workmen, while the welder himself wore a hood with a protecting glass. Despite this protection and verbal warnings, the bump of curiosity is so highly developed in some that they will endeavor to see what is going on, and as a result receive a flash, which in addition to intense pain causes them to lose time.

Much valuable time, energy and expense will be saved if a careful and complete ocular examination of employees is made when the positions require keen and accurate vision. Days spent in painstaking instruction of an individual with poor eyes, unable later to successfully carry on his work will thus be saved. I have in mind a large textile concern that never takes a girl in a certain department until after I have reported her vision emmetropic. Much time may also be saved by treating injuries at the plant. The employee who goes out generally goes home, puts on good clothes, consults the doctor, and takes the rest of the day off. Had his injury been treated at the plant, he would return to his work and finish the day. It has been found that the cases treated outside require longer time and are more troublesome than those cases treated routinely in the First Aid.

The foreman is the most important link in the chain of safety with which we are trying to encircle the workingman. It is to him the men look for orders, instructions, and explanations. He is in closest personal touch with them, and if he were alert and careful not to jeopardize his own life and limbs, and equally as careful about the men under him, there would be a marked lessening of accidents. Safety engineers may devise most effective safeguards, which go for naught if the ideas are conveyed to the men in the language or manner they cannot comprehend. The human factor must be properly considered, and psychology plays its most important part. Last Christmas, all the workmen of a large plant were presented with their Christmas pay, a gift envelope containing a check. Quite a number of the men threw them away without opening them, or stuck them in their pockets unlooked at. A clever cartoon depicting various phases of the work, drawn large enough to be seen 30 or 40 feet away, when posted on a large bulletin board seldom if ever fails to attract attention,

and the message it carries is driven home. The language of pictures is a universal one.

My statistical figures are compiled from the accident reports of a large shipbuilding plant with over 10,000 employees, which means, when we figure labor turnover, about 30,000 were hired during the year, where as Consulting Ophthalmic Surgeon, the care and management of all problems dealing with the eyes and vision of every employee is under my direct supervision. During the past year there were 21,715 accidents of all kinds. Of this number 8,076 or 36.6 per cent were eye cases. This large number of eye cases was due to intensive efforts to have every eye case, no matter how trivial report to the First Aid immediately after injury. That this course was justified is shown by the remarkably low number of serious eye cases. Only 119 men lost any time (other than the necessary time for treatment at the First Aid). The total number of compensable eye cases was 7. Of these, one man lost 5 days, one 3 days, and one 1 day, while four men received full compensation for the loss of an eye. Of these, two were healthy eyes developing traumatic cataract after a penetrating wound of the globe. Both eyes were operated and the men returned to work with protective vision in the injured eye. The other two were contusions to an old previously diseased eye, which resulted in the loss of vision.

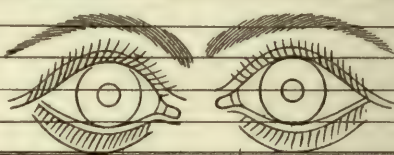
**MANAGEMENT OF EYE CASES.** The injured man reports to the First Aid and is seen by a nurse or assistant, who are permitted to remove only such foreign bodies as can be dislodged by a wet cotton applicator. If unsuccessful, the case is referred to the attending surgeon, who after a definite method of desensatization, attempts the removal with an eye spud. If unsuccessful, or if the man complains of great discomfort, or the eye appears inflamed or any question or dispute concerning the case arises, the patient is required to report to the Consulting Ophthalmic Surgeon, who is on duty every day between the hours of one and two, and in emergencies by telephone.

**RECORDS.** A 4x6 card contains all the medical information the first aid department keeps. The statistical records are kept elsewhere. This card acts as a check on every person handling the patient, and is most useful in preventing claims for minor accidents, or accidents which did not occur in the plant. The reverse side of the card can be used for making daily notations of treatments, visits, etc. The careful spotting

of a foreign body serves to protect us from unjust criticism when a second foreign body is found, which was claimed by the patient to have been the original injury and not removed.

The Americanization of employees is undoubtedly a most efficient aid in the prevention of general accidents, which necessarily includes eye injuries. Mr. E. E. Bach, Director of Americanization, Penna. Commission of Public Welfare, in an address before the Penna. Safety Congress at Harrisburg, March, 1920, presented some interesting facts and figures from which the following are quoted. "It will be of interest to you to note some of the definite results obtained through a working knowledge of English provided for foreign born

Form 544 2m 5-21

INJURY REPORT No. _____		COMPANY _____		VISION R L	
Name and Address _____		Dept. Number _____			
Date of Injury _____					
Diagnosis _____					
					
FOREIGN BODY	REMOVED BY	INITIAL	INJURY		
Metal	Cotton Probe			Laceration	
Scale	Spud			Abrasion	
Dirt	Burr			Contusion	
No F. B. No Injury	Flushing			Burn	
	TREATMENT			Welder Flash	
Upper Lid R—L					
Lower Lid R—L	Checked by Dr				

employees." "Eighty per cent of the injuries received by our workmen were among the non English speaking employees, although they constitute only thirty-four per cent of the force."—Commonwealth Steel Co., of St. Louis. "Accidents in the plants have decreased fifty-four per cent as employees are able to read factory notices and understand instructions."—Ford Motor Company, Detroit. "Moreover, while from year to year the frequency of accidents among English speaking decreased, it was much less affected among non English speakers, and the average severity of the temporary disabilities was greater among the latter."—Federal Department of Labor.

The most illuminating information we have in regard to the relation of the lack of knowledge of English to accidents is that recently published by Director Van H. Manning, of

the United States Bureau of Mines, in his last monthly statement of mine fatalities. He said, "The inability to read and understand English places the foreign born in danger of his life. The rate of accidents among the non English speaking miners is not only greater in all the mining districts of the country, but the increased ratio is uniform in all districts." This demonstrates clearly that inability to read warning signs, to comprehend fully the company's instructions, and to understand their foreman, places an unnecessary hazard upon the foreign born. Mr. Manning concludes his report with this striking statement: "Had the fatality and injury rate for the English speaking American been maintained throughout the three groups of mine employees, there would have been a saving of 716 fatalities and 900 very serious injuries, a strong argument for Americanization and education of the miner."

Table No. 9. Bulletin of the Penna. Department of Labor and Industry, Vol. 7, 1920, No. 2, publishes a table showing the number of compensable eye losses for 1919, and previous years, 16-17-18, with the amount of compensation paid for these losses which was in 1919, \$838,432.

Total number of accidents	1919	651
	1918	683
	1917	362
	1916	357

Table No. 1.

Total number of eye accidents reported in.....	1919	9,604	152,544	
	1918	11,727	184,844	Accidents
	1917	15,822	227,880	of all kinds
	1916	20,665	255,616	

Thus we see that in 1919, of the entire number of accidents reported to the State, injuries to eyes comprised 6.29 per cent in all classes of industry. The California Industrial Accident Commission reports a total of 52,348 eye injuries during the five years from 1914 to 1918 inclusive. Of these, 1,030 were permanent injuries and 51,318 temporary injuries, with fifteen cases of total blindness. Approximately 99 per cent of these 52,348 eye injuries were caused by flying objects. Complaints made by workers that goggles are heavy, disagreeable to wear and become clouded under some circumstances, have some measures of justification, but they speedily

disappear when confronted with the terrible array of eye injuries quoted.—California Safety News.

In an article on Shop Lighting, by C. W. Price, General Manager, National Safety Council, Chicago, Ill., the following facts were noted: Some three years ago a large insurance company analyzed 91,000 accidents reported for the purpose of discovering the causes of these mishaps. It was found that ten per cent were directly traceable to inadequate lighting, and in 13 8/10 per cent the same cause was a contributory factor. In a recent investigation of the causes of eye fatigue, made by the Industrial Commission of Wisconsin, it was found that in a large percentage of the industries, such as shoe, clothing, and textile factories, the lack of proper lighting (both natural and artificial) resulted in eye fatigue and loss of efficiency. For instance, in one knitting mill, where a girl was doing close work under improper lighting conditions, her efficiency dropped 50 per cent every day during the hours from 2:30 to 5:30 p. m. In a neighboring factory, where the work was quite exacting, but where ideal lighting conditions prevailed, a uniform standard of efficiency was maintained practically throughout the entire day.

SUMMARY. The advantages of an Ophthalmic Consultant are reaped by both the firm and the employees.

*To the employer:*

The men realize the firm is doing more than the Compensation law requires.—*Liberality.*

Men report more promptly for treatment, thus reducing the number of serious cases.—*Confidence.*

Expert treatment results in commendation rather than condemnation of the department.—*Praise.*

Reduction of lost time to a minimum reduces overhead and increases production.—*Profits.*

*To the Employees:*

Increases security of mind that expert care will more quickly restore injured parts to normal.—*Confidence.*

Reduction of lost time to a minimum helps to maintain a full pay envelope.—*Greater income.*

Maximum restoration of damaged vision reduces industrial cripples and helps to keep a job.—*Happiness.*

Less pain and suffering promotes a kindly feeling.—*Comfort.*

## OPHTHALMOLOGY AND SOCIAL SERVICE.

PERCY FRIDENBERG, M.D.

NEW YORK CITY.

The trend of the times is indicated in medicine, among other things, by the stress laid on cooperation and the development of teamwork. There is an important corollary to this point of view, which teaches us to deal with various agencies not only in the profession but in the community, as our aides and helpers in carrying out a comprehensive and constructive plan of campaign, which shall take in not only therapeutics but hygiene and prevention. The parent, the employer, the school teacher, the architect, the illuminating engineer, and last and perhaps most important, the school-child, can help us spread the doctrine to thousands where we could reach individuals only, and can teach us much from their point of view. The trained nurse too can help us in many ways, in clinic, hospital, and home, besides being an invaluable assistant in follow up work, and in the many branches of social service. Simple but definite teachings in the right use of the eyes, the dangers of neglect, the simple rules of personal hygiene, and the prevention of communication of eye disease can be given to Parents' Associations, in Nurses Training Schools, and as part of the regular curriculum in postgraduate medical schools. It is the prerogative and the particular duty of our profession to teach the laity the folly and the danger of risking sight and health with nostrums and secret or patent systems of eyesight cure, the numerous fake eye drops for cataract or for what these charlatans call "scum." It has been said that every profession has the parasites it deserves, and we are perhaps reaping a harvest of our own sowing when the community which we have allowed to grow up in ignorance and credulity entrusts its most precious possession, sight, to conscienceless clowns. In the press of today, we are regaled with a miracle story of the restoration of sight to the venerable Senator Gore by some simple but wonderful plan of fixing the attention on a small black object. The smallest black object that I can think of is the faker who for a few dirty dollars will trade on the hopes and fears of the blind. But looking at that object does not

help me any more than it helps their poor dupes. It merely fills me with disgust. In my talks to nurses and parents on the eyes of children, I lay stress on the importance of early, routine examinations of sight and estimation of refraction by a competent physician, at regular intervals. I am particularly insistent on the danger of neglecting headaches or treating them with home remedies or patent medicines. The same applies, at least as forcibly, to nervous symptoms, bad habits, laziness, tics, nausea, digestive disturbances, and the other protean manifestations of eyestrain. Simple common sense will keep good eyes good, and by that I mean merely not doing the utmost possible to ruin the eyes by bad light, bad type, bad position of head and body, and bad habits of reading on into the dusk, and so on. When we come to sociologic optics, we find there is not a little to be done in our conferences with teachers, school planners, and engineers. They can all teach us a great deal, and here it is our duty to learn as well as to instruct. The question of lighting has become one of paramount importance for visual efficiency as well as ocular health in factory, school, and home. It also plays an important part in the conservation of vision and in the prevention of eye injuries.

It may seem trite to remind you of the economic importance of good sight, but I do not think it can be stressed too often. Good vision is an open sesame to some occupations, as defective sight actually bars from them. Poor vision not only cuts down earning capacity, but predisposes to further loss of sight, via accident or disease. Poor vision, finally, is itself a direct cause of accident or injury either to the subject or to others. The druggist who is near sighted will mistake a 5 for a 3, and put up an overdose, or misread a label and put poison into a prescription, where none was intended. All skilled trades presuppose accurate sight, and our lives are entrusted to engineers, drivers, train dispatchers who have to do constantly with printed or, worse, hastily written instructions affecting hundreds. So it may not be out of place to mention these things in our talks to workmen and employers. We can show them the importance of visual tests, the necessity of well lighted factories without glare or intense shadows, the direct aid to efficiency in well diffused, agreeable light, and the dangers of dark or of dazzling work places in the machine shop.

The prevention of accidental injuries of the eye might seem an almost impossible task, if we did not have the experience of an advance almost as striking in a neighboring field. I refer to the complete disappearance of the old-fashioned Fourth of July with its burnings, maimings, blindings, and deaths, and the substitution of a safe and sane Fourth almost like magic, and in an incredibly short time, as the result of a concerted appeal by teachers, physicians, and the press, to the common sense and intelligence, as well as the self interest of the community and, most of all, to the younger generation. In the school and home, we can teach the dangers of playing with toy pistols, air rifles, sling shots, putty blowers, matches and lights, of trying to force open cans or tins without the right tools, the careless carrying of sticks, canes, throwing stones or playing with scissors, needles or knives, the right way and the wrong to work around hot fluids, the dangers of lyes and acids in the kitchen, and the absolute necessity of legible labels. In the factory we speak of first aid and the dangers of infection particularly by uncleanly methods of treatment, and the fact that slight injuries are turned into serious affections by well meant but clumsy or dirty methods of therapy, as well as by procrastination, or neglect of radical measures. The use of protective apparatus such as goggles, or screens and protectors about moving parts of machines or in blasts or furnaces, is another important point. There are many trades which are dangerous to the eyes, but the principles of accident prevention are about the same in all and by no means complicated. Injury cases need perhaps even more thorough disinfection than any others, and we should lay stress on this in our talks. A course of Injuries of the Eye should be part of the curriculum of every postgraduate medical school. In my course on this subject at the N. Y. P. G., I lay stress on the importance of good light, good assistance, good anesthesia and good fixation in our minor surgery of eye injuries, and this applies even to such an apparently small matter as picking a cinder off the cornea. Let us make of our postgraduate students not only capable and trained oculists, but propagandists who will take up the torch of hygienic precept and hand it on to teacher, parent, nurse, through the community.

## DISCUSSION OF INDUSTRIAL SYMPOSIUM.

PROF. J. VAN DER HOEVE, Leiden, Holland: These papers have been very interesting to me. I would like to ask Doctor Barkan what he thinks about the second eye in cases of interstitial keratitis provoked by trauma in one eye. I agree fully with Doctor Barkan that an accident can give rise to the beginning of interstitial keratitis, but we all know that interstitial keratitis of heredosyphilitic nature is nearly without exception bilateral. The inflammation in the first eye seems to provoke that in the second eye.

What now about insurance indemnity? When we give to the patient the benefit of the doubt for the inflammation in the first eye, according to my idea, we ought to do the same for the second eye. The real cause of the disease is the heredosyphilis; the accident is only the provocation, but it provokes as well the inflammation in the second eye (though indirectly), as it does that of the first eye directly. Therefore, I should say we ought to give indemnity for both eyes or for neither.

DR. E. M. SHANKLIN, Hammond, Indiana: The fact that this Academy has devoted its opening session to a symposium on industrial ophthalmology indicates to me that this subject is at last receiving the attention it deserves in this section.

Doctor Donovan has given us a real contribution to the literature of industrial ophthalmology, in my opinion, and I particularly wish to compliment him on his occupational classification. He has presented to us, in definite, concise form, all the data on this subject which has appeared in the literature from time to time, and I believe it is a valuable contribution.

To me the outstanding feature of the presentation of Doctor Cross is the fact that he had in this shipbuilding plant the most wonderful cooperation, first, of the employing company, second, of the employees, and third, of his staff. The wonderful record he has made in these thousands of eye injuries of all description is, of course, made possible only through absolute cooperation. I think his card index is the best one of its kind I have seen, and I wish to remind you again of what he calls the "spotting" system—fixing definitely on your record the exact location of these corneal injuries. I have had occasion more than once to be very glad that I used this system.

I agree with Doctor Cross that publicity and education are the important factors in accident prevention, as it relates to ophthalmology; but I would go a little bit farther. I would put more stress on the education of the employer, and more particularly the insurance company, if there is an insurance company back of the liability. In my experience it has required more time, patience and explanation to properly educate the employing company and the insurance company to the absolute need of employing skilled ophthalmologists for eye injuries. To the average employer and insurance company, the presence of a foreign body, particularly if it is imbedded in the cornea, is a trivial matter. I want to go on record as saying that the extraction of an imbedded foreign body is not trivial; it is a surgical operation.

Doctor Cross also speaks of the shop expert, the handy man, if you please. In the Calumet district we call him the storeroom expert, because formerly all injury cases, eye or otherwise, were referred to this storeroom expert, who used to boast how cleverly he could handle eye cases. But he has found himself out of an occupation so far as foreign bodies is concerned, and if he has persisted in doing this he is relieved of connection with the plant.

A word as to the sociologic phase. I want to leave this with you, particularly those who deal with foreign born laborers in steel mills. Most of our states have compensation laws which are clear as to the rights of the injured individual. Most of us know what the law implies in this matter, and therefore in closing I wish to say that the industrial surgeon has a right to explain to his patient, particularly if he is a foreigner, what his rights are under the law in order that this man may not have to give any part of his compensation to some lawyer. If we show these foreign born individuals that we are trying to be their friend by giving them proper advice as to their rights under the compensation law, we have given them the first lesson in Americanization.

DR. WILLIAM M. SWEET, Philadelphia: It is extremely difficult, as Doctor Cross has indicated, for large industrial establishments, which are interested financially and also in the efficiency of their workmen, to secure the proper cooperation of their employes in the use of the various safety measures provided for preventing injuries to the eyes. Protecting goggles are usually found in the workman's pocket; glass screens in front of emery wheels are removed, and the fellow workman is often consulted in preference to the First Aid Hospital for the removal of a foreign body. It is usually the individual worker, or the man with a single helper, who is careless in the use of protecting goggles. Some years ago I visited a large steel plant in Pittsburgh with Dr. Edward Stieren, where compressed air chipping tools were in use by a large gang of men. Every man was compelled to wear goggles, and each workman agreed to report his neighbor if seen at work without the eyes protected. There were consequently few reports of ocular injuries from this department of the plant.

The objection of the workman and his union to physical examination before employment is gradually disappearing with the better understanding of its value when properly conducted by broad minded employers. There is no attempt made to select the physically perfect, but the minor defects of the individual are considered in connection with his efficiency in the job for which he is best fitted, not alone generally, but also as to his eyes. A defect in sight that can be corrected with lenses is no bar to the man's employment, but if the deficiency in vision is such that the individual is unable to see his work clearly or to protect himself from injury by machinery, it is the duty of the examiner to refuse employment, unless a position is found where the man is reasonably safe from personal injury and does not become a menace to his fellow workers.

It has been my experience that a large proportion of the cases allowed partial compensation for visual disability were primarily trivial injuries, either improperly treated or not treated at all, and were followed by

corneal infection and central scars. In the coal regions, corneal injuries seem prone to be followed by pneumococcus ulceration, often with complete loss of function of the eye. Notwithstanding demonstrations and lectures on the importance of prompt treatment of all forms of eye injuries, (and these lectures are given in their own tongue, as many of the men are foreigners) it is only after a lapse of several days, when the eye becomes painful, that the First Aid Surgeon is consulted, and then the ulceration in most instances has reached a degree where the ultimate scars prevent useful vision.

I do not agree with Doctor Cross that it is advisable to allow a workman with an injured eye to return to work and finish the day after treatment at the First Aid Dispensary, unless the injury is trivial in character and the corneal epithelium has not been opened. In several industrial establishments with which I am acquainted, the chips of steel and particles of emery in the cornea are often deeply imbedded, and after removal leave considerable disturbance of the corneal epithelium. In all these cases, after removal of the foreign body, the eye is covered with a pad, which the man removes on reaching home, uses cold applications followed by a local aseptic wash, and the next morning reports to the First Aid before returning to work. In plants where there is dust and other foreign particles in the air, an open corneal wound invites infection.

As indicating the extent of eye injuries in Pennsylvania, Mr. Harry A. Mackey, Chairman of the Workmen's Compensation Board of this State, in a recent address stated that the awards for the loss of 3,364 eyes since the Board was organized in 1916 have totaled \$4,214,746. This compares with \$998,000 awarded for the loss of 527 legs; \$810,000 for 410 arms; \$2,294,000 for 1,351 hands, and \$1,029,000 for 703 feet.

In commenting on these figures Mr. Mackey said: "I think it is fair to say that the employer has done more to protect the eyesight of the employees than the employees themselves. There is a spirit of indifference and recklessness among workers in discarding goggles and protection devices. Education is our only means of arousing a full spirit of cooperation in the employee."

DR. JOSEPH C. BECK, Chicago: Doctor Donovan's paper is full of meat and should be read by everybody when published, but there are some antiquated things mentioned that must have come from some older literature, because the recent literature contains some newer ideas in regard to some of these occupational diseases. I would like to call attention to Prof. Roepk's textbook on occupational diseases of the ear alone. In this work, there is a great deal of attention paid to altitudes, particularly in aviation. Our members located at Dayton, Ohio, have a wonderful opportunity in this direction, as the U. S. Experiment Station is located at McCook's Field in that city. I had the pleasure of visiting it lately. They experiment there with reference to what the machines and the men can do. I do not know whether they have done anything from an otologic or rhinologic standpoint, although of course there has been much done in the late war.

The paper well brings out the question of people who are employed in basements and improperly ventilated offices, as this is one of the

greatest factors in the production of catarrhal rhinitis, pharyngitis, and progressive deafness.

The doctor says miners will not wear masks and therefore must suffer from the effects of coal dust and moisture. So far as I am informed, that is not exactly the case. They actually do wear nasal filters, and perforated plates in the mouth which do not interfere with respiration, but which filter out the excessive coal dust.

He speaks of chimney sweep cancer. The action of carbon as an etiologic factor in carcinoma is very important. Protection with lanolin is effective, but yet it is not taken advantage of as a protective measure by these men.

I was surprised to find so little in the doctor's paper about the effect of detachment of the membranous labyrinth. You remember Siebenmann and Alexander's work on animals in regard to detachment of the membranous labyrinth, while exploding guns close to the ears.

What surprises me most is that the Doctor is himself the champion shot of Montana—knows how to shoot—and pays so little attention to that as a causal factor of trouble. He speaks of the deafness of shell shock. There is no such thing. The people who are deaf from shell shock in most cases hear as well as you do. They do not want to hear. It is a mental condition, a hysteria. There is no pathology present at all. It is a neurotic condition and can be cured.

Noise can be prevented. There are plugs manufactured which go into the ear and deaden the noise. These are made of cotton and covered with paraffin. They should be used by men in noisy occupations.

Singer's fatigue is an occupational condition which affects the teachers as well as the pupils, the use of the voice in spite of fatigue producing a hyperkeratosis of the posterior third of the cord. Telephone operators do not have defective hearing from their occupation, says the doctor. I have made a study of a fairly large group of these people, and they do have a considerable rise of the lower tone limit, due, I think, to their occupation. The constant drumming on the telephone receiver must result in some change from the overactivity of these intratympanic muscles.

The last sentence of Doctor Donovan's paper is well worth reading—"They all die in bed."

All of the papers presented here this morning show that there is much to be done in an educational way. During the last few years, at our Illinois State Medical Association, one or the other otologist or ophthalmologist has been asked to speak to the public. It has been my great pleasure to talk to the public on several of these occasions on the conservation of hearing, and I think every man in this room should go home and not alone preach conservation of hearing, but give the public all the information possible with reference to occupational diseases and their prevention.

DR. F. PARK LEWIS, Buffalo, New York: In order that the valuable ideas brought out in these papers may bear fruit, it is necessary, as Doctor Fridenberg said, that there should be team work. The men who will apply these ideas are only those who are in some way directly connected with industrial plants, and a great majority of the men here are not. In order that there may be an application of these suggestions, there should

be in every community an organized group whose business it is to bring these talks to the notice of the public. It is the purpose of the National Committee for the Prevention of Blindness to aid in the formation of these groups. During the past year and previous years there have been vast numbers of pamphlets, wall placards, and even movies prepared, which are to be loaned throughout the United States, and it is the purpose of the National Committee to aid in the organization in the various cities of groups of men who can bring to the notice of the public important facts concerning the conservation of vision.

I simply wish to say that it would seem entirely appropriate that this Academy should have a committee to work in cooperation with the National Committee, so that there might be bodies formed in the various cities, the member of which could advise manufacturers and also employees on the subjects which have been brought up here in this connection.

DR. G. HENRY MUNDT, Chicago: I would like to emphasize two points. One is the importance of careful examination and a careful record of patients who have even the slightest eye injury. If an individual has an imbedded foreign body which denudes the corneal epithelium, certainly it should be located very accurately, and after removal that eye should be closed with a bandage so he cannot get at it to infect it.

Another thing, men should be carefully examined as to visual acuity before they go into employment, and this should be taken accurately by someone who is competent, not a man who is working around the office. If this is done with the viewpoint of the visual needs of the position to which the patient can advance, it will be a great assistance in the industrial world.

DR. L. W. JESSAMAN, Framingham, Massachusetts: I want to emphasize the fact that many men will not take advantage of the safeguards provided. They will put the safeguards, especially protecting glasses, in their pocket, and they will not wear glasses at the emery wheel. I have occasion to see a good many injuries from industrial plants, especially from emery, and emery is one of the things that becomes imbedded very deeply. It is thrown from the wheel with considerable speed, it is hot, and becomes deeply buried in cornea and is often difficult to remove.

It is important to take the vision before a person is employed, and another important thing is to keep tabs on the vision of employees.

One thing about school children has not been mentioned. I believe in all cases where children are referred for examination of the eyes, and there is a reason why one or both eyes cannot be brought up to normal, there should be a system whereby the ophthalmic report would be made a part of the school record. It would save a great deal of time and inconvenience to the child and the parents, and it would also save numerous reexaminations that are entirely unnecessary.

DR. EDWARD STIEREN, Pittsburgh, Pennsylvania: The steel company to which Doctor Sweet referred is the Jones & Laughlin Company, which in normal times employs about forty thousand men. I have been engaged by them for twelve years, during the first two years of which I merely took care of injured eyes. Then I was able to convince them that it

was much cheaper to prevent eyes from being injured than to have them injured and pay bills for surgeon and hospital, and of course compensation for time off. I was finally given carte blanche to install the safeguards which I thought best to prevent eye injuries. In the first place, their safety organization was much augmented. Their plants are scattered over a large area and they had at that time five so-called "safety men." That number was increased to fifty under the direction of a safety engineer. Our organization comprises a chief ophthalmic surgeon and an associate; four medical men who have had training in minor eye surgery; one or more dressing stations in each plant presided over by a nurse who has had special training in eye work. If a foreign body cannot be removed from a holocainized eye by wiping with a sterile cotton armed probe, the nurse refers the patient to one of the dressing station surgeons. No nurse is permitted to touch an eye with a sharp instrument.

After the foreign body has been removed, a two percent solution of homatropin is instilled, the conjunctival sac is filled with 1-3000 bichlorid ointment, and the eye bandaged until the next day. We rarely have an ulcer of the cornea, and when it does occur it is usually among the coal mine employees, men of low resistance and of careless hygiene.

The figures which Doctor Cross gave us—that out of 8076 cases only seven received compensation—are certainly to be commended. I wish, however, to direct attention to his statistics that there were 8076 eye injuries out of 10,000 employees, more than 80 per cent.

In 1917-18, during the strenuous time of the war, when skilled labor was hard to get and much unskilled labor was employed, and men were unfamiliar with their work and environment, in the 40,000 employees in our plants, the eye injuries ran only about 18 per cent.

I would like also to say a few words about trachoma. In 1914 there was an epidemic of trachoma throughout the industries of the United States, especially in the Middle West. I had an opportunity to study some 300 cases at that time, and coincident with that epidemic there came into our clinic in the hospital a number of adults and children suffering with a severe form of follicular conjunctivitis. In the trachoma cases, even very early, when examined with the Zeiss or other binocular loupe, an encroachment of blood vessels accompanied by a slight haze of the cornea can invariably be detected at the upper limbus.

This beginning pannus is never seen in the follicular cases, even though they have existed for several years.

These investigations were made the subject of a paper which my associate, Doctor V. E. Van Kirk, presented to the Eye, Ear, Nose and Throat Section of the Medical Society of the State of Pennsylvania, at the 1916 session.

DR. HANS BARKAN, San Francisco (closing): Replying to Professor Van der Hoeve's question regarding the second eye, I agree that the inflammation of the second eye is the result of the trauma to the first one. I was very glad to hear him say that there were such cases following trauma, because it is a disputed point. But from the industrial standpoint, from the standpoint of compensation, it is a different matter. I looked over the industrial insurance reports from 1914 to

1921, covering their eye cases. Out of six cases, three were an interstitial keratitis following trauma. It happened that two cases were over thirty, they were congenital syphilitics, and the keratitis followed a blow; but I gave it as my opinion that they should have compensation, not only for the eye which was struck, but for the second eye. The third was a boy of seventeen, struck in one eye, and the insurance company protested against compensation. In that case they asked me whether the case might not have been spontaneous, whether it might not have occurred without the blow, and I said it might. They said they would indemnify him for the first eye, but would not compensate him for the other eye.

We went through all the opinions rendered by the Commissioners. They of course are laymen, and they take a doctor's opinion for what it is worth. Their first interest is the working man, and if your opinion does not fit in with what they think is just to the working man it is disregarded. I will quote one striking case to show the mental workings of the lay commissioners. A man was struck on the cheek and tooth broken. His employer and the insurance company were willing to compensate him for the loss of the tooth, or get him a new tooth; but he said, "Yes, but I wear a plate, and the plate is broken. I want the plate restored." The employer and insurance company refused to do this, and the case came before the Commissioners. The Commissioners disagreed, two of them thought he should not be compensated because the plate was personal property, and that if he had broken his stickpin he would not expect to be compensated, and that this was the same thing. But the third Commissioner said the man should receive compensation because he would not be a good workman if he had indigestion, and he surely would have indigestion if he had no plate and could not masticate his food.

DR. JOHN A. DONOVAN, Butte, Mont. (closing): I would just like to say to Doctor Beck that I cut the reading of my paper down to thirty-five minutes, and as a consequence I left out a good deal.

DR. GEORGE H. CROSS, Chester, Pa. (closing): When a large area of the corneal epithelium has been denuded, or when the foreign body is located deep in the corneal stroma, it is not our practice to return the workman to his task without a protective dressing, if his occupation is a hazardous one; his button is taken up and he is given a red cross button to wear until he is pronounced safe to resume his occupation, when his work button is restored and he can check in.

Infection of the cornea is practically unknown when we get a case before any outside interference. Of great help in removing foreign body burns and in smoothing a rough spot are the corneal burrs, devised I have been informed by Dr. Burwell of California.

Dr. Stieren spoke of the rather large proportion of eye cases quoted. This is due to intensive efforts to have every employee if injured, or if he merely has dust blown in his eyes, to report to the first aid hospital and have them washed out. The comfort and relief is well worth the short time expended.

That we are dealing with a very important phase of industrial life is evidenced by the following facts published in the daily press of September 24th, which were abstracted from a report of the Committee

on Elimination of Waste in Industries of the American Engineering Council.

"The total number of industrial blind in the United States is given as 15,000, or 13.5 per cent. of the total blind population."

"The eye it is declared is involved in 10.6 per cent. of all permanently disabling industrial accidents."

Protective methods as applied in large plants have affected a great reduction in injuries. The use of goggles is one of the chief protective devices.

That correction of substandard vision produces an increase in return that will pay for its cost, is the conclusion of the management in plants where several years of trial has provided a basis for judgment.

DR. P. H. FRIDENBERG, New York City (closing): One of the agencies in the prevention of blindness has been our "safe and sane" Fourth of July. Not so long ago that idea was Utopian, but today the old fashioned Fourth of July is almost a memory.

Doctor Lewis called attention to some of the work of the National Committee for the Prevention of Blindness, but he very modestly left out the mention of what he has done in the Society, nor did he mention the tremendous scope of their work—the propaganda work, the missionary work, the instruction of mothers and midwives and physicians on the matter of babies' sore eyes and trachoma, the matter of industrial injuries—these are merely a few of the branches they take up. There is a whole system of education. The Russell Sage Foundation furnished some valuable material which I use in my course at the Post Graduate, and in addition I have added a series of slides showing such simple manipulations as the inspection of the eye, eversion of the lid, irrigation, application of bandages, and the preparation of the eye for minor operations. I go over these things again and again until the men know exactly what is to be done in these cases. They have to know that, and how to get adequate illumination and fixation, how to get sufficient anesthesia, before they even attempt to take out a foreign body.

There is an old saying: "For want of a nail the shoe was lost; for want of a shoe the horse was lost; and for want of a horse the rider was lost." And so for want of some of the minor things preceding the operation, we may have had results in attempting to remove a foreign body from the eye.

In our lectures we lay great stress on first aid and emergency treatment of minor injuries, and the importance of asepsis and of keeping the eye under observation. This, with the energetic and scientific treatment of infected foreign bodies, wounds and ulcers at the very first stage, will save many eyes. The surgeons' activity does not end with the patient. He has a community duty to perform in instructing the patient, the nurse, the teacher and the parent. Let us work and teach so that the time may come when people will no longer be led by false hopes and false fears by fakirs who claim to heal blindness. In the paper which I hold in my hand there is a long account of Senator Gore's blindness, which, as you know, is of long standing. The healer who has gotten the Senator into his care is curing him by having him rest his mind by fixing a small black object, and so on. Now, the smallest black

object I can think of is the medical charlatan, but it does not rest my mind to think of him. It fills me with disgust.

One of the difficulties we have to contend with in teaching is the uneven preparation of the students taking the postgraduate course. Some are recent graduates, well trained in theoretic medicine as well as in the latest phases of biology, physical chemistry, and immunology. Others are good experienced medical men with years of practice, but little preparatory training in natural science, optics, or mathematics. These men want "points" and are bored to death by theories of refraction and the fine analysis of muscle balance. This unevenness of material makes for repetitions, delays for explanations, and loss of system in teaching. It lays upon us postgraduate instructors the added duty of working for a better curriculum in medical schools, and for more thorough work in the colleges, particularly in the courses preparatory to the study of medicine. I might go further, and include the high school, for there the foundations of mathematics and natural science are laid, which are so important for a thorough understanding of ophthalmology.

# THE VALUE IN DIAGNOSIS AND TREATMENT OF A COMPLETE EXAMINATION BY AN OTO- LARYNGOLOGIC GROUP.

JOSEPH C. BECK, M.D., and HARRY L. POLLOCK, M.D.

CHICAGO, ILL.

DR. BECK.

What we intend to present for your criticism today, is our method of conducting an Oto-Laryngologic practice in the widest possible scope. By this we mean the inclusion of the borderline subjects. It is not intended to demonstrate an ideal or perfect system, but we hope to elicit a discussion from which we may profit and add, thereby improving what we already have, and thus perhaps benefiting others. We trust that the personal references in the paper will be pardoned, same having been made use of only to serve as trite examples.

At the present time, there is a nation wide movement to convert the practice of medicine into the group system, that is, to coordinate the various specialties into an association and partnership. The purpose of all this is to make better diagnoses, improve the treatment of disease, and economize both for the patient as well as the doctor. The net result should be a successful, profitable practice and a more happy state of mind for all concerned. It is stated by those that have had experience in the group practice of medicine, that more scientific attainments have resulted in consequence of that method of practice.

Owing to the fact that my three brothers, Drs. Carl, Emil, Rudolph and myself started to practice medicine in Chicago at about the same time (1895), it was a natural procedure for us to form a group or partnership and lay the foundation for dividing the work into specialties. It was probably the first general group that was thought of in that sense. Dr. Carl Beck was to be the general surgeon; Dr. Emil, the internist; Dr. Rudolph, the dental and oral surgeon; and I was to take charge of the eye, ear, nose and throat department. To attain the highest possible training along these lines, we all went abroad alternately for longer or shorter periods of time. We very soon discovered that there was considerable handicap in trying to practice group work in a hospital where

other, and many, men were in attendance. Consequently, it was decided to build a small private hospital and limit the work to diagnosis and surgery, leaving out the treatment of the nonsurgical branches. This decision required the changing and enlarging of the staff, Dr. Emil taking up the special surgery of the chest and extremities, Dr. Carl Beck doing the work in abdominal and pelvic surgery, and I taking over that which pertained to the head and neck. Dr. Rudolph continued to do the dental work. Of course the internist, radiologist and laboratory technician were engaged along with the balance of the auxiliary staff, including assistants, anesthetist, surgical nurses, superintendents, resident physicians and clerks. With the founding of this organization, general practice, especially regular house calls, ceased for all connected therewith. After two years' association with this group, I read a paper before the Southern Section of the Triological Society, entitled "Office and Hospital Equipment in Oto-Laryngology," in which I expressed satisfaction in my association with the group. However, a year or two later, I came upon an unsurmountable difficulty, namely; the restriction put upon me in matters of consultation. This came about, because of our agreement to consult only the members of the group when consultation was required relative to a condition within their field; exception to this to be made only in rare cases, or when the patient requested other consultants. Consequently I severed my association with the group, although remaining connected with the hospital.

I then organized an oto-laryngologic group, including borderline work. This required an associate as well as the engaging of a laboratory technician, the radiologist being shared by my brothers and ourselves. I say "ourselves" advisedly because of the existence of my associate, Dr. Pollock. At this time, I would like to state that such an association is one of the most important factors in the success of any group. This is especially true, when the person chosen for that position possesses all the necessary qualifications of an associate, namely; a sense of honor, diligence, good training, and ability to perform practically all the work which the senior or coassociate, himself, does. The last named qualification is of particular value when one member goes away for any great length of time, and expects the practice to go on in a normal manner. There is, however, one difficulty that may, and frequently does, arise when one's associate comes

up to that standard, and that is a petty jealousy which may lead to disruption. The only method by which this difficulty may be conquered lies in the willingness of each man to be broadminded enough to give and take. The senior associate must encourage enthusiasm on the part of the junior, and the latter must recognize the senior's as a more ripe judgment, and submit at times even though he may be in the right. I might add here that in the groups we have observed, the financial end appears to have given most trouble and this factor, too, has often led to the breaking up of an association. It is impossible for us to understand why this should be. Surely the financial division should be on the basis of the merit system. Should the junior man show greater merit by honest endeavor, his monetary compensation should be consistently greater than that of the senior. It stands to reason that the latter must recognize these facts, and make arrangements accordingly. The most unsatisfactory means of settling the financial end of an association is the making of a contract other than a gentleman's agreement, for what sort of a partnership could develop under compulsion? There is one fact that the junior men should always remember, and that is that the pioneer of the group built up the association, and that is stock in trade for which continuous compensation is warranted.

To return to the matter of our group as it then stood, we were now an independent one and by virtue of that fact, were enable to choose the particular consultant desirable in each individual case, thus making it possible to make better diagnoses and attain more successful results in treatment. Our staff this time consisted of a special anethetist (doctor) well trained in local as well as general anesthetics as employed in oto-laryngology, surgical nurse well versed in the technic of head and neck operations, a clinical nurse of the same caliber, and two resident assistants who were in training for a period of one year, general hospital training or general practice for a period of more than two years, having been a prerequisite for this special internship. The usual clerical force of bookkeeper, recording secretary and correspondent, reception room attendant, and errand boy completed the staff. Following two years of this type of group practice, I made a report to this Academy on October 5th, 1915, entitled, "Relation of Oto-Laryngology to Other Specialties—Team Work," believing that we had gone about as far as possible and feeling

well satisfied. Alas! We found that we were handicapped in our routine diagnoses, in that we were obliged to refer our patients to outside consultants, necessitating a considerable delay, unnecessary expense, and in the majority of instances, receiving a negative or confusing report. It frequently occurred that we referred a patient to an internist, and he in turn notified us that the patient required a neurologic or gynecologic or some other specialist's examination.

Consequently, we made another change a little less than a year ago, and we now feel that we finally have a satisfactory plan of practice from every point of view, excepting one which we hope to have in the near future, that is, the ownership or control of a special hospital connected with private offices. Anticipating the report of the Oto-Laryngological Committee of the American Medical Association on requirements for special practice, we determined not to take men into training for less than two years, requiring as a prerequisite that they be graduated from a Class A medical school, and have hospital internship for at least one and one half years in an institution recognized by the American Medical Association in their department of Hospital Standardization. Such men are qualified to make a complete physical examination in every field, and have a sufficient knowledge of Laboratory methods to enable them to control the technician's results. These men are then our general diagnosticians, and if, during their examinations, they find some pathologic lesions in other fields of medicine, or if they are in doubt as to their findings, they make their reports to us, and we determine whether a consultant is indicated and who the consultant will be.

I would add that the men enjoy this part of the work and the responsibility it affords, as it keeps them in closer touch with general medicine. The final change made in our staff up to the present time was the taking on of a freshman otolaryngologist, Dr. Bernheimer. This was done owing to our recognition of the necessity of looking ahead to a successor, and it is understood by Dr. Bernheimer that within a few years he will become an associate.

DR. POLLOCK.

As stated in the paper, it is not the purpose to present a perfect system nor to foist upon others our method of carrying on a practice, for everyone will have to develop his own individual system according to his environment, etc. But we do feel that

by giving our experience, for which we work hard and have paid dearly, we may be of some assistance to those that are looking to the future.

(1) To illustrate a case, where an accepted first class group, as well as an individual Oto-Laryngologist, permitted a case to pass through its hands without making the diagnosis of a comparatively simple pathologic condition, let me briefly report the same: A man of about 35 years of age, married, a merchant by occupation, developed—fairly acutely—difficulty in swallowing, and after being examined by his local physician, in one of our smaller cities, was referred to this well established group clinic. Here, after more than three weeks during which period more than ten men examined him, and he was put through various laboratory tests, he was told that he was a nervous man and had a spasmodic stricture of the esophagus. However, no help was given him. By this time his difficulty in swallowing had increased and he had lost much in weight and strength. At this time he was referred to a Laryngologist who works by himself, and limits his work not to include borderline subjects. This specialist also declared himself unable to find anything wrong. Six weeks after the patient was first examined by his family physician, he presented himself to us and while the case was not absolutely evident at first glance, it did point to an abscess at the base of the tongue, which diagnosis was verified by incision and evacuation of pus. The patient was cured. The conclusion to be drawn in the case is that in the group system, too many men examined the patient, each looking for something peculiar to his specialty. In the case of the individual laryngologist, his was a greater fault in not going beyond his limited field of nose and throat examination.

(2) To emphasize the importance referred to in the paper, of making use in every instance of good laboratory methods, let me cite this case: A man, age 30, was referred to us for operation on his nose, a diagnosis of possible sarcoma having been made. Our examination showed a marked swelling of all the intranasal structures, especially the septum. It is true that the patient denied venereal disease, was married and had two healthy children, otherwise giving no evidence of lues, but when his blood was examined, the report showed a four plus Wassermann. An intensive antiluetic treatment (salvarsan) cleared the case up quickly.

(3) To demonstrate the viciousness of the work of the

many inefficient groups all over the country, let me mention the most salient points in a case, which if time and space permitted, would be reported in detail. A maiden lady, about 35 years of age, highly nervous, complained of pains about her ears. She was referred to an institution in a smaller city which is advertised as emulating the largest group clinic in the northern part of the United States. In other words, they claim to have a specialist in every branch of medicine. After a very brief examination by every man on the staff of said group, the entire examination taking one-half day, the patient was advised to have a double mastoid operation done. This was performed but the patient's condition did not improve, rather getting worse, and she was again operated upon. The patient was, by this time, much worse, having now several added symptoms such as deafness, dizziness, vertigo and inability to hold up her head without having it supported by another person or herself. The group was now in desperation and made a final effort in having their otologist in combination with the general surgeon operate on both mastoids. Following this, the patient's condition grew worse rather than showing any improvement. At this point the patient was referred to us and as stated above, I wish that I could go into the interesting details of the case, but they are too lengthy for the purpose of this paper. In the first place, the patient gave no history of discharge from her ears at any time. Her hearing was not affected before the operation, and at no time was there a test made of her hearing or of her static labyrinth. No laboratory test had been made of her blood, etc., until after the operation and on questioning the nurse who had been on the case before, it was learned that no neurologic or ophthalmologic examination had been made. One glance at the patient's behavior, especially in attempting to raise her head, should have made a tiro in medicine suspicious of a hysteria. After a thorough examination, in which we found the vestibular apparatus functioning normally, we called in a neurologist who pronounced the case that of a grave hysteria. His suggestions for treatment, were, however, not followed. At the urgent request on the part of the patient's family, we explored one of the mastoids and found no evidence of infection or any other trouble that could produce the symptoms. To the surprise of her family, the patient heard practically normally immediately after the operation, and all the other symptoms almost entirely disappeared, so

that she was able to attend a picture show at the end of the first week and returned home after two weeks. We referred her to a competent otologist near her home for further observation, and hear from him that thus far, the exploration has had the desired suggestive effect. Relative to this case, we do not wish to be misunderstood to say that we recommend a surgical procedure for the cure of a hysteric affection. The result here was purely coincidental with an exploratory diagnosis.

(4) Two of the most frequent complaints in reference to which we are consulted are (1) progressive loss of hearing or deafness and (2) head pain or headache. Both of these conditions require thorough analysis, inasmuch as the symptoms may be and frequently are associated with various general or ocular pathologic conditions. It is particularly here that our present method of handling the cases has shown itself to be of most value. Therefore permit me to very briefly carry a case thru from beginning to end. After a brief meeting of the patient and either one of the writers with an inquiry regarding the complaint, the assistant is introduced and instructed to obtain a thorough history and then make examination of the nose, throat and ear, including the functional tests and transillumination. The assistant is told this, in every instance, so that the patient may know that we desire him to make the examination, for the patient may otherwise suspect that he is not going to be examined by the man to whom he was referred. When this preliminary work is finished, either one of the writers sees the patient with the assistant and goes over the cardinal points in the history as well as verifying, correcting, or amplifying the findings or the history. The patient is now told that a further examination (general, physical, X-ray, and laboratory work) is necessary and unless the patient is referred by a physician or otherwise recognized as responsible, he is informed as to the probable cost of such examination. I would add here that unless this is done, one will find considerable difficulty in collecting after the examination is made. The same assistant follows the case thruout its course, makes a complete physical examination with notation of each finding in the history. It may be well to say something here concerning the type of histories we use. Probably nothing in our institution has given us more trouble than this matter. Without going into the evolution of same, let me say that the present method is that of

each assistant writing up his own case from beginning to end in a small uniform notebook bearing the patient's name and address. This book is a small paper bound one, six by three and three-quarter inches in size, containing twenty double pages. All notations made therein must be in ink. In this book may be found the report of exhibits, such as X-ray pictures, specimens, etc. Record is also therein made of all correspondence, X-rays and specimens filed. Going back to the course of a case, when the completed examination made by the assistant is finished and all results including those of the X-ray and laboratory are in his hands, we again see the patient together and try to make a diagnosis. In case of the assistant having found some general condition, or even suspecting same being present, a consultant is called in (a man specializing in that particular field). It stands to reason that in a single or selfevident ear, nose or throat condition, as for instance a cerumenal plug in the ear, we do not go thru such an elaborate process. Should operation or treatment be advised, the same assistant follows the case to the operating room or in treatment, keeping a clear record until the case is concluded and the patient leaves the service.

(5) Let us consider the case of a patient afflicted with asthma as he presents himself at our clinic. This type of case probably presents more forcibly the value of an Oto-Laryngologic Group as described by Dr. Beck. As many of these cases have a sinus condition present, most often hyperplastic ethmoiditis, they are first given a complete otolaryngologic examination including the ordinary laboratory test, as blood and X-ray examination. The assistant makes the physical examination and records the findings. Inasmuch as all of these cases are tested for a protein sensitization, they are referred to a specialist in this line of work. If we were in a group practice, we would of necessity send them to our internist who might not be as competent as a specialist in this particular field, and hence we could not obtain as accurate information as to the patient's sensitization as is required. Consequently the patient would not secure the best advice which he seeks. This exemplifies one of the most vicious forms of group practice, not yet referred to, namely: that in which a number of general practitioners form a group and without proper training, call themselves specialists, one becoming the surgeon, one an internist, one an oto-laryngologist, etc. Most often the experienced oto-laryngologist

of the city in which such a group is formed, refuses to go into the combine, and inasmuch as the oto-laryngologist is required to complete the group, an incompetent man is frequently selected, with the result that inferior work is done, which throws the entire group into disrepute.

In conclusion we wish to state that a great many more examples could be brought forth, giving evidence of why we think this mode of procedure is good, but we believe that after all, it will be necessary that it be tried and reported upon by others for further verification and perfection.

#### DISCUSSION.

DR. HAROLD I. LILLIE, Rochester, Minnesota: Doctor Beck has so well covered the subject, that there is little left to say. There are two or three points which I would like to emphasize in the discussion of this paper. The practice of general or special medicine has as its function the welfare of the patient. The organization of general or special groups for the practice of medicine was brought about by the particular needs and conditions that existed. It is generally recognized in medical circles to-day that there can be no such thing as a panspecialist. Unfortunately, it too frequently occurs that a patient, presenting himself to a nose and throat specialist, is always considered a nose and throat patient thereafter. The fact that general conditions may have particular manifestations in the nose and throat is frequently lost sight of.

I do not believe it possible for a group of men to get together, choose a location, and say, "We will practice group medicine." It must be a matter of evolution, depending largely upon the needs and conditions as they exist in any community.

DR. W. A. DEFNET, Detroit: Dr. Beck has so covered the entire situation with Dr. Lillie, that I have very little to say, other than this, that the associates must be picked with a great deal of care and much thought given to their personality.

DR. BECK, Chicago (closing): I think the discussion could be continued at the Round Table much better than in a hall like this. Many men would like to discuss this and we will do better around the round table.

## PROGRESS OF GRADUATE TEACHING IN OPHTHALMOLOGY.

EDWARD JACKSON, M.D.

DENVER, COLORADO.

In 1836 Wills Hospital was opened in Philadelphia, with the provision that physicians and students of medicine should be freely admitted to its clinics; but it has never given systematized instruction. In 1883 the Philadelphia Polyclinic was organized to afford clinical teaching in the different branches of medicine and surgery to graduates in medicine. It gave six weeks courses, which might be repeated indefinitely. The chance thus offered to become acquainted with diseases of the eye became a gateway to ophthalmic practice.

In 1911 a paper read before the section on Ophthalmology of the A. M. A., and the discussion it elicited, brought out the defects of the existing methods of preparing for special practice. Ten years before that, the outline of what was needed in this direction had been submitted to the Dean of the Medical Department of the University of Pennsylvania. In 1912 a conference on the graduate teaching of ophthalmology was held in Minneapolis, the evening before the meeting of the American Medical Association, which developed definite suggestions and crystallized the demand for improvement in ophthalmic instruction.

In 1910 Mr. Doyne, with the support of Prof. Osler, had instituted a graduate course leading to a Diploma in Ophthalmology, at Oxford, England. In 1912 the University of Colorado established a somewhat similar course leading to the degree of Doctor of Ophthalmology. In 1915 the American Board for Ophthalmic Examinations was organized, to encourage and support better preparation in ophthalmology on the part of those making it their specialty; and it now exerts a strong influence in this direction.

In the last year, there have been given in several institutions in the United States better organized and more effective courses in ophthalmology, than were ever given before in the world. The graduate teaching of this branch is being reorganized, much as the undergraduate teaching of medicine was reorganized in this country nearly fifty years ago. We

have made notable progress in the recent past; let us see what needs to be done next.

The plan submitted to Dr. Marshall twenty years ago outlined "a course extending through one collegiate year, including:

(1) Such instruction as is now given to all candidates for the medical degree.

(2) Laboratory work: (a) The exact anatomy and histology of the eye; the anatomy of the orbit and neighboring cavities; the anatomy of the nerves, and the portions of the central nervous system that have to do with vision and the accessory visual apparatus. (b) Special pathology, including the modifications of general pathologic processes as they are manifest in the eye, and such special processes as clouding of the media, glaucoma, etc., with the bacteriology of the conjunctiva. (c) Training in the accurate, delicate manipulations required in operative ophthalmic surgery.

(3) A course on refraction. (a) Mathematical optics, including drill in the actual working out of the simpler geometric and algebraic problems. (b) Physiologic optics; about the territory occupied by the works of Holmholtz or Tscherning, but necessarily restricted to the fundamental facts and general outlines. (c) The errors of refraction, their diagnosis and correction.

(4) A more complete course in the diagnosis and treatment of diseases of the eye than can be given to the general medical student. This should include three or more hours a week of lectures with quizzing and individual instruction.

(5) Instruction in neurology and neuropathology, both as to general processes and principles of diagnosis and treatment, and as regards the significance and associations of ocular symptoms of general disease."

These specifications have been well met in the course given by the University of Pennsylvania in the past year, in its Graduate School of Medicine, the Medico-Chirurgical College. They have been met equally well and with clinical training amplified in courses given at the University of Michigan; and in connection with the University of Minnesota, both at Minneapolis and at Rochester. Essential portions of such a course are given at various other institutions. But such a course is not yet available for the large number of men and women to be specially trained for ophthalmic prac-

tice, that are needed each year to replace those who retire, and to extend the service of the ophthalmic specialist to the whole population of the United States.

There were opportunities for 17 at the University of Pennsylvania, 10 at the University of Colorado, 6 at the University of Minnesota, 1 at the University of Michigan. Less than 40 all told, who had opportunity to profit by the kind of instruction every ophthalmologist ought to have, before engaging in special practice. This is about one-tenth of the number who ought to be getting such instruction every year. Of the older methods, the best were service as assistant in a teaching clinic, or as intern in an ophthalmic hospital. These provide for less than half the annual demand for specialists. So, even to-day, half of those who are to treat the eyes of the people of this country, have to depend on the short, voluntary, un-systematic, clinical courses of a generation ago. There is nothing else open to them. Experiments have been tried, methods have been worked out, the time has now come to apply them more widely.

There was started in 1911 "a demand on the part of the medical profession for the adequate teaching of ophthalmology in all well equipped, efficient schools of medicine." Only a few have yet met that demand, its importance still needs to be emphasized, and many more such institutions induced to undertake it. Meanwhile we must advertise such schools as do meet it, and see that their facilities are taxed to the limit with students fitted and eager to profit by them.

GOING FORWARD: This brings us fairly to face plans for future progress. In preparation for ophthalmic practice, instruction is required in two different groups of subjects. First the fundamentals, anatomy of the eye and related parts, including histology and embryology; physiologic optics including refraction and ocular movements; methods of diagnosis; and special pathology, including pathologic histology, ophthalmoscopy and microscopy of the living eye. These can be given chiefly as are other laboratory courses without bringing the student into contact with any large number of patients. Even the foundation of ophthalmoscopy and the use of the corneal microscope can be acquired without the resources of any large clinic. They can be given partly by lectures to large classes, but mostly by demonstrations to limited groups, as other laboratory branches.

Second, clinical work, the application of knowledge and skill on the individual patient. This requires and always will require all the clinical material available, one patient for one or a very few students, and the largest number of patients to furnish a broad acquaintance with ocular disease. Each student must himself apply the diagnostic methods he has learned; must in his own mind group the facts observed and draw his own deductions. It is possible for the instructor to assist in this only by constantly watching the work of the student, by following his individual methods and mental processes, by correcting his errors and pointing out his deficiencies as these become apparent.

Broadly, then, there are two kinds of training that must be given those who are preparing for ophthalmic practice: first, preparation to understand what is to be seen in the clinical case, and this is possible in any well equipped medical school, with competent instructors in fundamental branches and adequate laboratory facilities; and, second, clinical experience in a teaching clinic, whether that be in a great ophthalmic hospital, or in the private office of a practicing ophthalmologist. Only it is essential that the student have the fundamental knowledge before he attempts to profit by clinical work.

The National Board of Medical Examiners has taken a long step forward in dividing their examinations into 3 parts. It will help to make undergraduate and general clinical work in our medical schools more systematic and effective. The American Board for Ophthalmic Examinations should divide its examinations into two parts. The first part, dealing with fundamental branches and methods of examining the patient, might be given any time after a year following the taking of the degree of Doctor of Medicine. The other should come after one, two or three years of actual clinical work in ophthalmology. Even if it consisted only of preparing case records, it would then be a test of real fitness for special practice.

When institutions that give clinical instruction in ophthalmology require of their students evidence that they have that acquaintance with fundamentals that will enable them to profit by the cases they see, it will be a great advance in special teaching; and it will raise the standing of such schools with our profession. It is as rational a requirement, from the educational point of view, as requiring the medical student to have

a certain minimum of general education before studying medicine, as all reputable medical schools now do. But such a requirement for graduate students is not now generally possible, because most students lack the fundamental training, and under present conditions are unable to get it. The effort to prepare medical men for their clinical course in ophthalmology by correspondence courses fundamental thereto, has aroused ridicule and contempt, instead of understanding and appreciation. When the better medical schools and universities offer opportunities for fundamental training, we shall have the right to demand that clinical opportunities shall be confined to those who can profit by them.

The great obstacle to establishing courses in fundamental instruction in ophthalmology is the difficulty in finding competent instructors who will give the necessary time to it. But this could be overcome in any strong medical school that undertook to offer such courses. Special anatomy, histology, etc. can be taught by the "full time" men who have charge of those departments of anatomy and histology. Pathology can be partly so taught, but physiologic optics, ophthalmoscopy, and methods of examination must be taught by ophthalmologists; and it has been very difficult to find those who will give enough of their time to it. The time is coming when they must be paid for it, and still more the importance of such teaching must be generally recognized.

The need of proper recognition is ever greater with regard to clinical teaching of real value. In this the proportion of instructors must be still larger; and the field of clinical cases that are used for instruction must be extended. The older plan of teaching medicine and surgery by apprenticeship, or preceptorship offered great advantages in clinical teaching. It fell into disuse because the clinical opportunities were put before men not fitted to profit by them thru fundamental study. When students have been prepared by fundamental study to profit by clinical advantages in ophthalmology, we must return to something of a modified preceptorship. To those who can serve as our assistants, we can interpret the clinical pictures that pass before them, and by so doing raise the general standard of ophthalmic education above any former level.

Our profession does not exist primarily that we may make money. By the fact that we are in it, we have assumed certain

obligations to repay our debt to the past, and to our colleagues by instructing our fellow workers and particularly those who come after us. The essential basis of our profession is: "I will keep this oath and stipulation: to reckon him who taught me this art equally dear to me as my parents: to regard his offspring as on the same footing as my own brothers, and to teach them this art if they wish to learn it, without fee or stipulation; and that by precept, lecture and every other mode of instruction. I will impart a knowledge of the art to my own sons and those of my teachers, and to disciples bound by stipulation and oath according to the law of medicine." That is the first pledge of the oath of Hippocrates. It is the implied pledge of every fellow of this Academy. Let us keep it; and by so doing serve in our day and generation.

#### DISCUSSION.

DR. WM. H. WILDER, Chicago: After making a few remarks on this subject, I am going to pass around among the members some reprints of the report that has been made by a special committee of the Council on Medical Education at the special meeting last March in Chicago, when this subject of graduate instruction in all branches of medicine was brought up.

The American Board for Ophthalmic Examination, in which this Academy is represented, was appointed by the Council on Medical Education as the Committee to prepare a report on the subject of Graduate Instruction in Ophthalmology. You will probably be interested in reading the report.

Graduate work and instruction in ophthalmology should be arranged to meet the requirements of three classes of individuals:

First, practicing ophthalmologists who desire to freshen or increase their knowledge of ophthalmology as a whole, or along some particular line, and can spare only a few weeks at a time to do this. For such there should be arranged short courses, both clinical and fundamental, and such persons should be urged to take courses in fundamental subjects that they may need, and not limit themselves, as is so frequently done, to desultory clinical work. Beginners in ophthalmology should be discouraged from attempting to prepare for the practice of this specialty by taking these short courses, as is so generally done at present.

Second, graduates in medicine who desire to prepare for the special practice of ophthalmology. For this class there should be a systematic course, and it is the opinion of the American Board for Ophthalmic Examinations, who have given the subject considerable study, the results of which are embodied in a report made to the Council on Medical Education of the American Medical Association, that a period of two years is the minimum to allow for such training. This, of course, is a much higher standard than has prevailed in the past, but the Board

feels that it is the least that it can recommend for future graduates who desire to engage in the special practice of ophthalmology.

Quoting from the report of the Board to the Council on Medical Education referred to:

"Of these two years, the first should be devoted to systematic work divided about equally between fundamental subjects and clinical subjects. And the second should be a hospital year, preferably spent as intern in a special hospital, as assistant in a well organized eye clinic, or, lacking such opportunities, as private assistant in the service of a competent ophthalmologist.

The fundamental should include:

- (1) Topographic anatomy of the head and neck.
- (2) Histology and embryology of the eye.
- (3) General pathology and bacteriology (with special reference to diseased conditions bearing on ophthalmology).
- (4) Physics of light.
- (5) Physiologic optics.
- (7) Psychology of vision.
- (8) Neurology.

The study of these subjects might be carried on in the laboratories of a university, if such were available.

The clinical studies in ophthalmology should include special pathology and bacteriology of the eye; preparation of histories and records; principles of refraction, including skiascopy; ophthalmoscopy; external eye disease; internal eye disease; practical refraction and skiascopy; the eye muscles; perimetry; examination of color sense and of light sense; relation of eye to internal medicine, neurology, pediatrics, dermatology and syphilology; industrial medicine; public health; hygiene and therapeutics; ophthalmic surgery.

The work in fundamentals and the clinical work should, if possible, be carried on together, one in the morning and the other in the afternoon. In this way there would be better correlation of the various subjects, and the student's interest and zeal would be stimulated.

As to the apportionment of time for the various subdivisions, the Board is not prepared to make any but the most general recommendations. How many hours to allot to anatomy, gross and minute, how many to physiology, embryology, pathology, how many to the various clinical subjects, is a matter for the teachers in each school to work out for themselves. Advice in this matter should be based on experience, and there is not enough available for a decision, as heretofore nearly all such teaching has been clinical and haphazard, and not fundamental or systematic. It seems certain however, that the time necessary to cover the field of physiology adequately should be greater than for any of the other fundamental subjects above mentioned. The recent graduate has been over the subjects of anatomy, embryology and pathology in his undergraduate courses in such a manner that all that is needed now is a review, with further detailed study along the same line. While the subject of physiology has been given him in his first undergraduate year, what he has now to master is more unfamiliar both to the student and the teacher than the other parts of ophthalmology. If the future ophthal-

mologist is to master the subjects of physiology of the retina, which includes the sense of light, color sense, form sense, central vision and peripheral vision; of image formation; of eye movements and protection; of stereoscopic vision and diplopia, with practical application of all these in ophthalmoscopy; retinoscopy, measurement of refraction by various methods; the testing of ocular motility and binocular vision; the taking of fields; testing of the light sense, the science and art of illumination; etc.; he will need to spend a good many hours in the laboratory and clinic as well as in reading.

After a certain amount of instruction in the methods of examination and the principles of this subject, the student should be required to make an exhaustive examination of each case assigned to him, carefully recording all his findings, and this work should be checked up at frequent intervals by a competent superior.

As the student progresses, he should be given opportunity to assist in the regular work of the clinic or dispensary, and to do independent work under suitable direction.

Operative courses should be given only when the student has acquired a good foundation for them and the ability to examine the patient to determine the indications for operation.

The student should be directed in his reading and encouraged to become familiar with the best literature on the subject. If he has no reading knowledge of either French or German, he should be urged to acquire this knowledge of one or preferably of both languages.

It is further recommended that following this year of preparation, there should be if possible a year of internship in a recognized ophthalmic hospital, or a year as assistant in a well organized eye clinic. If these are not available, a year as assistant in the office of a reliable ophthalmologist might be accepted, provided the duties assigned the assistant are of educational value. It is recommended that hospitals organize their house staffs with the demand for training of specialists in view. To this end there should be a large number of externs, interns and voluntary assistants and a goodly number of fellowships, some with and some without small stipends. In this way provision would be made for a large number of students, some remaining several years pursuing advanced studies and research leading to a higher degree. Until such desirable facilities are obtained, the out patient department of Class A medical schools, and the dispensaries in connection with ophthalmic hospitals would be suitable places for carrying on the clinical work of such a program.

Graduate instruction in ophthalmology should include facilities for a third class, who wish more thorough preparation, either for practice, for research or for teaching. Courses of this more extended character should follow the one just described, but should last from one to two years longer, and provision should be made for the sort of work that would be required. Fellowships would form the best basis for this extended training. Universities should be willing to confer some degree, as Ph.D., for such prolonged work.

DR. W. L. BENEDICT, Rochester, Minn.: The teaching of ophthalmology in postgraduate schools has received considerable attention of

late years, and attempts have been made by many schools to arrange a course that would meet the demands of the student, and provide better preparation for those whose aim is to confine their practice to diseases of the eye. There is a demand on the part of the student for adequate schools and clinical facilities, which American institutions, while recognizing, have been slow to provide. The great attendance of American students at foreign clinics is a strong indication that the desire for better schooling comes from the student himself, and is not forced upon him by regulation.

American schools are now attempting to provide for both our own and foreign students sufficient room and clinical facilities out of our wealth of material, that it may be utilized by a greater number at a smaller expenditure.

Progress in ophthalmology has been made in three dimensions, and the young student must learn more before he can forge ahead, than was required of men of a previous generation. Starting from the same zero point, he must go over the work that has been done in the past. The next generation must go still further, and so on. So there is every reason why the curriculum should change and stress be placed upon certain courses as ground work, the basis of future development.

The physics of light is well worked out, so that a solid basis has been formed upon which to build optical practice, but we must be ever ready to accept new things in physiology, and make physiologic optics elastic enough to include whatever new features may be developed.

Likewise, anatomy and pathology must be considered as fundamentals, and required as stepping stones to desirable clinical heights. However well grounded one may become in fundamentals, there is still a human element in the practice of ophthalmology among our people that must be reckoned with, and that can be developed only with time. I refer to the judgment one must use in considering clinical data, upon which to base a diagnosis and prescribe adequate treatment. This requires actual working experience under direct supervision of adequate and unbiased clinicians, with all available clinical and laboratory data before one. The value of this personal contact cannot be overestimated, and the student has the right to demand of his instructors that competent and unselfish aid be at his disposal.

Large classes are at a disadvantage by reason of the loss of this contact with instructors, and classes must be arranged so as to care for the many students; more and more places must be provided where the proper teaching can be carried on. More time must be given to teaching, and teaching positions in the schools must be held by men who are willing to give their time, and who like that kind of work.

Less time in undergraduate courses might profitably be arranged and more time added to the postgraduate courses for those who intend to follow ophthalmology. The student as an ophthalmologist must be impressed with the necessity of broadening his study in general medicine and neurology, as well as perfecting himself in the practice of pure ophthalmology. There is a distinct place for this form of associated work in the ophthalmic postgraduate school. The student sees

the need of it. The internist is asking that ophthalmic consultants be better prepared, and the teachers must meet this demand.

DR. WALTER B. LANCASTER, Boston: I was invited to assist the American Board for Ophthalmic Examinations in their examination held yesterday, and I was impressed by the singularly effective means this affords of judging the *teaching* of ophthalmology in this country. The candidates represent the upper stratum of ophthalmologists, those who have had the best teaching obtainable. One gets the chance of judging the teaching, as well as the taught. The teaching must stand or fall by the results.

The weakness of ophthalmic teaching in America lies in the lack of fundamental instruction. Imagine the teaching of medicine in the undergraduate schools if anatomy, physiology, and so forth were taught only as incidentals. Give up all laboratory work, and make the teaching purely clinical, graduate men without a knowledge of the laboratory subjects, and you would have a state of affairs comparable to what now obtains in the teaching of ophthalmology. Of the several fundamental subjects, anatomy, physiology, pathology, I should say that physiology is the weakest. I have said this before. This is being realized by others outside our own ranks. For example, last winter, thanks to the invitation of Prof. Richtmyer of Cornell, a group was formed by the National Research Council of men interested in physiologic optics to promote progress in that subject. Physiologic optics is a division of science with very many subdivisions or affiliations. Workers in many branches of science besides ophthalmology are actively interested in one or more of these subdivisions of physiologic optics. It was found that workers in one branch were apt to be ignorant of what was being done and had been accomplished in affiliated or overlapping fields. It is folly to ignore the work done in fields closely related to your own.

We have had a series of fruitful meetings financed by the National Research Council. The Committee includes one representative from each of the following fields: physics, biophysics, photochemistry, art, optics, engineering, Bureau of Standards, psychology, physiology, ophthalmology. We expect to organize a section on vision at the meeting of the Optical Society of America next week, and are preparing a monograph on recent researches in physiologic optics, and may produce a translation of Helmholtz' physiologic optics, the classical work on that subject.

It was easy for the ophthalmologist to point out to the other members of this committee that the most crying need in his subdivision of physiologic optics is the lack of text-books and of teachers of satisfactory training in physiologic optics. While our present experience demonstrates a lamentable deficiency, there is light on the horizon, and some of us think we can see some signs of approaching day. Perhaps one day soon, the sun will be above the horizon.

DR. WALTER R. PARKER, Detroit, Michigan: The difficulty in discussing the subject of graduate teaching arises from the fact that we do not have the same condition in mind. There are at least three classes of students to be dealt with, namely, the recent graduate who is willing to devote two or three years to his preparation; the man who has had a

considerable practice but is not well founded, and the well trained man who desires to keep up by taking a short intensive course every year or so. Each group could be dealt with without difficulty if a proper classification could be made. But when all grades are in the same class, the problem becomes complicated. The chief danger arises from giving too short a course for the unprepared.

I shall speak only from an experience in teaching recent graduates, or those who have had only general hospital training, and who desire to devote three or even four years to their training.

At the University of Michigan, the service is for three years, one year as intern, one as an assistant, and the third as an instructor. The instructor quizzes the Junior students in sections on the lectures given by the Assistant Professor. The course covers embryology, anatomy, physiology, and the elements of physiologic optics. As the work is gone over five times during the year (once for each section), the teacher at least is certain to learn the subject as covered in the lecture. The plan of introducing teaching as part of the staff work has proven most satisfactory. It keeps up the interest and adds to the enthusiasm of the work. We have been at a loss to know how to advise recent graduates concerning their training before taking up special staff work. Much time may be lost by an intern in a general hospital, who knows he is to take up "special" training and is willing to devote two or three years to qualify himself for his life work. We have recently adopted this plan. The recent graduate who is to do special staff work later is loaned out the first year. He spends six weeks in a summer course in pathologic technic, then six weeks vacation. In the fall, three months are spent at the bedside and in the laboratory work in the department of internal medicine. From there to neurology, and from there to syphilis, finally a six weeks course in neuropathology. After this training, the regular duties of intern in the ophthalmologic department are taken up, to be followed by two years of staff work as outlined above. The plan is new with us, but I hope it will work out to be the best interest of the student.

If every well organized clinic, especially those connected with teaching institutions, could add an auxiliary staff of three, each man to remain three years, one well trained ophthalmologist could be graduated each year from every clinic thus organized. After the system was established, the senior staff members could instruct the juniors. All work should be under the supervision of some member of the permanent staff.

DR. T. B. HOLLOWAY, Philadelphia, Pa.: Dr. Jackson has been good enough to refer to the work we have been endeavoring to do in Philadelphia. I wish to assure you the task has been a difficult one. A well graded course, clinical material and teachers are all essential.

DR. MARTIN COHEN, New York City: One phase of the subject interests me, the phase of the request made by a great many men from the South and the West who want both branches, and it seems to me this is a large percent of men. They require a minimum of time, for economic reasons, to acquire these specialties. Most require four months for ear, four for nose and throat and four months for the eye. That seems to be general with the majority of men who seek these specialties. Abroad they can acquire these in a year, and in some places possibly

less. I think the three specialties could be covered possibly in a year. That is the phase of the work I would ask Dr. Jackson to speak of, along these lines.

DR. PERCY FRIDENBERG, New York City: The difficulties of teaching are increased by the fact that our material is not uniform. If we are teaching a graduate class in a well equipped medical college, we have a normal material to work on. But in the Post-Graduate in New York, we have a different class of men to work on. One man will be well equipped in modern chemistry, etc., and knows what we are talking about. Next sits a man who has had years of practice, and comes to brush up on a practical course. He likes the practical course, and is bored by the course on physiologic optics, because it takes under consideration things of which he does not know. We have to have a preparatory class or work back, to give a man a foundation in mathematics and chemistry which he will never know. He thinks he took it at high school and at college, but he does not know for sure. You have to explain to these men the simplest principles of the physiology of light. It is difficult to get this information over in a postgraduate school.

DR. E. JACKSON, Denver, Colo. (closing discussion): Beginning with the difficulty of attempting to teach differently prepared students in the same class, we have to get away from that. It belongs to the day when men were taught in classes of hundreds by didactic lectures, and that is not teaching, in the modern sense, at all. We have to recognize the different needs. The needs of the practitioner who comes for a short review, is met in the work this Academy has just begun to develop by its program of this year. There is no reason why such a course should be limited to three days or a week. In an academy of this kind, it would be the quickest and best way of meeting the needs of a very large number of the profession; whether with the elementary, fundamental branches, or a review of the latest advances such as we have had at this meeting from Professor van der Hoeve. Whatever the needs we find, we should meet them so far as we can. At present this is a more important function than giving an opportunity of reading "original" papers or discussing them at our meetings.

Then there is the class of young men who want to train for thorough work in their specialties. That is what we have had in mind especially for graduate teaching; and other speakers, like Dr. Parker and Dr. Benedict have referred to it. But there is the other important class—the largest class of all—that Dr. Cohen has referred to, the men who wish to include more than one specialty in their practice. This affords a peculiarly favorable opportunity for teaching. Not all schools can have the full day on one branch, but they can with the three specialties. In many cities it would be impossible to do what they have done in Philadelphia, give the students an all day course on one branch, but they would be able to give a course of equal efficiency on all three branches; because they have many more instructors to draw upon. They ought to be engaged to develop such courses.

But the practical reason for bringing this subject before the Academy is to enlist the cooperation and assistance of the profession practicing ophthalmology and oto-laryngology in teaching. All the Fellows of the Academy should, first, understand the necessity, and then spread the

propaganda in educational institutions and among members of the profession, and exert a pressure upon those who are teachers, to stimulate them to do more and better work in the direction where it is so urgently called for, and they finally themselves ought to join in the work of teaching. Perhaps there are two hundred fellows in this Academy, who have never had assistants in their offices. They could have for their choice the best material that could be found, to give assistance in the ordinary way, and besides get the great advantage of teaching these assistants their specialties. They would find their own work improved by such teaching at the end of a few weeks.

Finally we should urge that all clinics should be open to the properly prepared students—the clinical opportunities of every public clinic. The teaching of our professional successors brings greater honors, more substantial and permanent rewards than come to us in any other way. That could not be better illustrated than by examination of the life and attainments of the man we have had with us this morning, Professor Fuchs.

# SPECIMENS ILLUSTRATING OPERATIVE AURAL SURGERY AND THE MAKING BY GRADUATE STUDENTS OF PREPARATIONS SHOWING AURAL SURGICAL ANATOMY.

DR. E. B. GLEASON, M.D.

PHILADELPHIA.

The writing of this paper was inspired by the statement of George E. Shambaugh in his introduction to the chapter on the surgical anatomy of the ear in Loeb's "Operative Surgery of the Nose, Throat and Ear." "The first problem for the surgeon who would undertake the operations on the ear is to master the details of the anatomy of this region. This cannot be acquired from textbooks, nor is this knowledge readily gained by attempts to do these operations on the cadaver. A thorough grasp of the complicated anatomy of the temporal bone is best acquired by the study of preparations made especially to show this or that relation. The knowledge comes through the actual making and handling of such preparations."

As to preparations to be actually handled by students in illustrating a cadaver course on the surgery of the ear, a minimum outfit should consist of specimens showing each of the more common operations either on macerated and bleached skulls, dried heads or wet preparations; supplemented by anatomic preparations on detached temporal bones, showing the more common anomalies. Briefly, it is as follows:

1. The temporal bone of an infant at birth, separated into the annulus, ossicles, squamous and petrous portions.
2. The simple, and radical operation on the skull of an infant at birth.

Supplementary specimens: 2-A. Malleus, incus, stapes. 2-B. Malleo-incudal articulation on the "Scute," or outer bony wall of the tympanum. 2-C. Ankylosis of this articulation.

These specimens show the ossicles, tympanum, antrum and internal ear of practically the same size as in the adult; developmental changes being due to the growth of the mastoid process with the formation of pneumatic cells, should these form, and to the growth of the external auditory canal (tym-

panic bone), resulting in a changed position of the stylomastoid foramen. It is no longer on the external surface of the skull as in the infant. Consequently, the lower portion of the primary incision of the mastoid operation should be further back than in an adult. The antrum is somewhat posterior to the posterior tubercle of the annulus, and between it and the linea temporalis.

Preparations illustrating ear operations are better shown upon a half head or a whole skull from which the calvaria has been removed, than on detached temporal bones; because, the average student has difficulty in visualizing the relationship of a detached temporal bone to the skull. He usually holds a temporal bone as if the squama and inner wall of the tympanum were vertical and the facial canal sloped downward, backward and outward from it, while in the skull the descending portion of the facial canal is always vertical, and the plane of the inner wall of the tympanum is downward, inward and forward. Hence the antrum is always more superficial than the rest of the tympanum.

The specimens should be of such a character as not to be readily injured by rough handling or contact with dirt. They are supposed to be handed around while students are at work, and are occasionally dropped on the floor, and otherwise maltreated.

Landmarks for the mastoid operations: 3. In this specimen a portion of the descending part of the facial canal is laid open and tinted red; the contour of the surrounding parts has been preserved as much as possible, particular pains being taken to preserve the pyramid that contained the stapedius muscle in order to show what portion of the inner wall of the canal can be removed in the radical mastoid operation without endangering the facial nerve. The posterior portion of the prominence of the horizontal semicircular canal has been uncapped in the position where it is most frequently laid open by a careless operator in mastoid operations. On the other side of the specimen, the superficial landmarks for the mastoid operations are shown, the semicircular canals laid open, and the tegmen removed. The line of the descending portion of the facial nerve is a straight vertical line between the stylomastoid foramen and a point just posterior to the oval window. The root of the styloid process can usually be felt with the finger tip during a mastoid operation. Under such circumstances, the stylomastoid foramen lies immediately beneath the

finger tip and in a radical mastoid operation, when the stapes can be seen, the line of the facial nerve is a straight line between the finger tip and a point immediately posterior to the stapes. A very important part of a cadaver course is the exposure of the horizontal and vertical part of the facial nerve. The cleavage planes of the bone are such that the vertical portion can be laid bare by two strokes of the chisel, so directed as to remove a triangular piece of bone between the oval window and the stylomastoid foramen; but by a student, the bone is much better removed layer by layer; the curve of the nerve downward behind the oval window, where the bone over the nerve is very thin, being the starting point and principal landmark for the dissection.

Supplementary specimens: 3-A. Superficial landmarks. 3-B. Section parallel to the meatus in a small celled pneumatic mastoid. The tegmen has been removed to show the position of the "boss" of the external semicircular canal, the ossicles and other "internal" landmarks.

3-C. Radical mastoid with horizontal and vertical portions of the facial nerve laid open. Both the external and the posterior semicircular canals are laid open. Part of the tegmen has been removed and the dura exposed. Nearly all the accidents that could happen to an unfortunate operator in a mastoid operation are shown in the specimen.

3-D. This specimen shows an extremely superficial and anterior position of the sigmoid sinus; so that it would be difficult to expose the antrum by the usual method without wounding the sinus. The bone is of the infantile type, and the antrum very small. (See also 4-A. and 4-B.)

The mastoid operations: 4. A skull, on one side of which a simple mastoid operation has been done and on the other a radical. A comparison of this specimen with the dissection of the facial nerve in 3 shows how much of the wall between the tympanum and the artificial cavity in the bone it is safe to remove in a radical mastoid operation. At the inner portion it is rather greater than would appear safe to the uninitiated.

Supplementary Specimens: 4-A. The Stacke's operation. From this operation, by combination with the simple mastoid operation, was developed the modern radical mastoid operation. A modification of Stacke's operation is occasionally performed at the present time in connection with the removal of the ossicles in chronic otorrhea.

4 B. and C. These specimens illustrate the difficulty of exposing the antrum when the sigmoid sinus is superficial and far forward. In both the specimens the antrum is of normal size. However, the difficulty of reaching the antrum is not as great as in specimen 3-D.

The sigmoid sinus, otic brain abscess and the internal ear:  
5. One side of this skull shows the operation for exposing and opening the sigmoid portion of the lateral sinus. The operation has been done on a dried head, the dura remaining intact. The other side of the head shows a Jansen-Neumann operation, and a detached temporal bone. 5-A. The simpler Hinsburg operation. Both specimens show the removal of the tegmen and the removal of the bone of Trautmann's triangle with exposure of the dura as in the search for a suspected brain abscess in these localities.

Supplementary specimens: 5-A 1. Temporo-sphenoidal abscess. 2. Jansen-Neumann operation without exposing the dura. 5-B. Hinsburg operation. 2. Removal of bone for temporo-sphenoidal abscess. 3. Perisinus abscess.

The internal ear: 6. A skull with the semicircular canals of both ears laid open.

Supplementary specimens: 6-A. Specimen showing the proximity of the internal carotid to the anterior portion of the first turn of the cochlea.

6-B. Topography of the horizontal portion of the facial nerve in relation to the vestibule and cochlea.

6-C. Vertical portion of the facial nerve.

2. The vestibule, showing position of the ampulla and indifferent ends of the semicircular canals.

Preparation of specimens showing the surgical anatomy of the ear by graduate students: As in dentistry, a candidate for the degree of D.D.S. is required to present specimen of his skill in making artificial dentures, so a graduate student should be required to present specimens of his work showing the surgical anatomy of the ear. In the dead room, a work bench, motor, burrs, and other tools and instruments necessary for the purpose should be at his disposal.

He should be encouraged to produce specimens rivaling in beautiful display of anatomic details those imported from France, like those kindly loaned for our inspection by Dr. Philip Stout, but at present nothing more is contemplated than the production of specimens showing the structures of

most surgical importance in the more common operations upon the ear.

7. This specimen is especially recommended as an example of this type. The anterior wall of the external auditory canal has been removed to show the external surface of the drum head. The posterior portion of the internal meatus, has been removed to afford a view of its fundus. The tegmen has been removed and shows the antrum with the cellular structure of the bone surrounding the antrum. The inner surface of the drum head, ossicles and muscles are plainly in view. Trautmann's triangle and the capsule of the labyrinth are shown. The capsule is laid open in such a manner as to show the vestibule, semicircular canals, cochlea, the first part of the course of the facial nerve within the temporal bone, and the geniculate ganglion. The surgical relations of the sigmoid, inferior and superior petrosal sinuses, and the bulb of the jugular vein are shown. A sufficient amount of the upper portion of the carotid canal is removed to show the proximity of the internal carotid to the cochlea and Eustachian tube.

8. Is a similar dissection of the macerated and bleached temporal bone.

9. Is a dissection made in such a manner as to show better than specimens 7 and 8 the course of the facial nerve and the relation of the cochlea, vestibule, horizontal and superior semicircular canals to the inner wall of the tympanum. All of these structures are laid open but the fenestra remain intact. It is possible for a student to make either of the specimens 7, 8, or 9, in two or three hours; but a longer time is well spent, as a familiarity with the important anatomic structures of the temporal bone, and their relationship to each other is best acquired by the slow and careful making of such specimens. It is probable that specimens made with a burr are superior to sections made with a saw for learning the anatomy of the parts. However, the methods can sometimes be combined to advantage as in 9 and 10. The most useful sections for displaying important anatomic structures are vertical and horizontal sections through the external and internal meati, and vertical sections through the tubo-tympanic axis and through the petrous bone, parallel to the axis.

10. Is a section through the tubo-tympanic axis enabling the worker to readily open the labyrinth from the inner wall of the tympanum. Trautmann's triangle has been partly re-

moved in order to better show the capsule of the labyrinth. This is laid open. The fenestra are left intact. The horizontal and vertical portions of the facial canal are better shown in this specimen than in most of the others.

Dr. Frank A. Bridgett has kindly loaned for inspection, some of the specimens he made during his cadaver course a year ago.

TRANSACTIONS  
OF THE  
TWENTY-SIXTH ANNUAL MEETING

OF THE  
  
**American**  
**Academy of Ophthalmology**  
**and Oto-Laryngology**

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OPHTHALMOLOGIC DIVISION



Part I.—THE MUSCLE ADVANCEMENT OPERATION: A  
TWIN SINGLE STITCH METHOD. Part II.—PARTIAL  
TENDON TRANSPLANTATION OF OCULAR MUS-  
CLES.

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The first part of the paper which I shall read, is practically the same as that which I presented before the Pennsylvania State Medical Society a year ago, in praise of the single stitch advancement operation as described by Jackson, but with this difference, that I would recommend the employment of two mattress sutures instead of one.

My excuse for venturing to repeat virtually what I said a year ago is the temptation offered by this occasion to commend the procedure to such a large body of ophthalmologists. My Pennsylvania colleagues who heard my former paper will, I hope, in sympathy with this desire, pardon the repetition.

As described by Jackson in "A System of Ophthalmic Operations," Vol. 1, p. 707 and 708:

"A curved incision in the conjunctiva and episcleral tissue is made, 10 mm. long and concave to the cornea. The flap toward the canthus is held up and dissected free from the sclera by snips of the scissors. The dissection is first to be made a little above or below the insertion of the internus, until one blade of the Prince advancement forceps can be slipped beneath the tendon, back from the insertion almost as far as it will be necessary to place the suture. The other blade of the forceps is pressed on the surface of the conjunctiva, so that the whole mass of tissue to be advanced is caught between the blades, which are closed upon it. With the flap thus held, the insertion of the tendon and all other adhesions of the flap to the globe are divided by snips of the scissors. The flap can then be drawn forward into its desired relation with the eyeball and the position of the suture necessary to retain it there and the amount of redundant tissues to be removed, decided on.

The finest curved needle is then passed through the flap from the conjunctiva to the scleral surface, back of the blades of the advancement forceps and about 2 mm. above (or below) the center of the tendon. The needle is then passed into the sclera,

parallel to the corneal margin and 1 mm. from it, in such a way as to take a firm hold in the sclera without passing through it. It should include one-fourth or one-third the thickness of the sclera, and the points of entrance and emergence should be 3 to 4 mm. apart. If at the first attempt the needle cuts or pulls out of the firm tissue, it should be introduced a little deeper and a little further back from the cornea. The needle is then passed beneath the flap and through it from the sclera to the conjunctival surface, back of the blades of the forceps, opposite the original point of entry, and 2 mm. below (or above) the center of the tendon—that is 4 mm. from the first entrance. Any tissue that will be clearly redundant, including that held in the forceps, should now be excised, the flap drawn forward, and the suture tied. If after this there still remains redundant tissue, it may then be trimmed away.

Generally the above suture is all that is necessary and upon it is to be placed the chief reliance for the success of the advancement. If, however, there appears a tendency of the conjunctival wound to gape near its upper and lower angles, or if the tissue seems to be much dragged toward the central suture, with tendency to narrow the new attachment of the tendon to the eyeball, additional sutures may be placed above and below the first one. To introduce such a suture, thrust one blade of the forceps beneath the flap, and raise the tissues from the sclera. The needle may be rather larger than for the first stitch and carrying thicker silk. It is thrust from the conjunctival to the scleral surface of the flap, then carried under the conjunctiva above (or below) the cornea close to its margin, almost to its vertical meridian, but without any attempt to enter the sclera. This suture should be so placed that beside closing the conjunctival wound, it will tend to spread the end of the tendon and secure as broad an attachment as possible for it in its new position.

The after treatment consists in keeping both eyes closed for the first day with a light dressing, cleansing the eye once or twice daily, and continuing the dressing on the operated eye for four or five days. The sutures should remain from four to eight days. Early removal of the stitches is indicated when the effect seems likely to be excessive, or when profuse conjunctival discharge develops."

The one objection I have found to this method is the amount of tension placed upon the scleral anchorage in some cases of

very marked deviations, in consequence of which, the stitch may cut through the tissues on the third or fourth day after the operation, thereby nullifying the effect of the operation. This has been overcome by the employment of two sutures instead of one, placing them parallel with one another, the superior including the upper half of the tendon, the inferior the lower half. This does away with the necessity of employing the two superficial stitches described above.

As I pointed out a year ago, the virtues of this operation consist in the following: 1. Its simplicity. The procedure is really nothing more surgically than the conjunctival incision, the resection of the muscle and its sublying tissues, and the closing of the wound by two mattress sutures.

2. The avoidance of looping or knotting the suture in the muscle, which tends to impede the vascular supply of the tissues and produces unfavorable reaction, and also renders the removal of the stitches difficult.

3. The simultaneous inclusion of all the tissues in the suture prevents the pulling out of its muscular anchorage, which sometimes happens when the muscle alone is secured.

4. The slight traumatism done to the parts and the absence of puckering and rucking of the tissues.

The scleral anchorage stitch should be inserted as far forward as possible (e.g., as close to the corneal margin) to obtain the maximum effect. The operation aims at a real advancement of the muscle and its surrounding tissues as well as their resection. A degree of caution must be exercised not to resect too much of the capsule, else the orbital ligaments are shortened unduly and the effect of the operation negatived. In tying the sutures and closing the wound, the flap should be drawn forward into the proper position by forceps and then tied to its new insertion. If the flap is advanced in the act of tightening the sutures, the latter are likely to cut through the tissues and the results of the operation be minimized.

#### PART II. PARTIAL TENDON TRANSPLANTATION OF OCULAR MUSCLES.

Although Giesler, in his comprehensive dissertation on partial transplantation of ocular muscles, asserts that Missa employed tendon anastomoses elsewhere in the body as early as 1770, Motais, when he devised his procedure for ptosis in 1899, was the first to employ such a procedure in ophthalmic surgery, his operation, as is well known, consisting in resecting some of the fibers of the functioning superior rectus muscle and joining them to the

paretic levator, thereby innervating the latter muscle and overcoming the drooping of the lid.

Dransart, in 1907, attached the tendon of the superior oblique, which had been torn from its attachment by an accident, to the external rectus muscle, and later overcame a ptosis in the same case by joining the stump of the levator with the trochlearis. Pfalz, also, has cited a case of paralysis of the external and superior oblique muscles in which, on account of the extreme thinness of the tendon of the superior rectus, he sewed the entire tendon of the superior rectus to the externus. The results were only fair, but he reported the case to show that one might transplant the entire tendon of the superior or inferior rectus. A number of other surgeons have innervated paralyzed muscles by similar transplantations of the entire muscle with varying results.

In 1907 also, Hummelsheim corrected a case of paralysis of the external rectus muscle by transplanting portions of the healthy superior and inferior recti muscles upon the externus, and subsequently reported 3 other cases of an allied nature. His technic consisted in an incision over the external rectus muscle, through which the tendons of the superior and inferior recti were exposed, and split centrally to about 12 mm. back of their insertions. Their temporal halves were then sutured to the insertion of the paralyzed muscle.

Other operators followed with successful cases, Stuelp in Germany and Harris of our own country tenotomizing the internus at the time of the resection of the other muscles.

In 1919, O'Connor, in a case of paralysis of the right external rectus muscle, proceeded as follows:

The externus and outer portions of the vertical recti were exposed thru a long incision concentric with the cornea and about 1 cm. distant therefrom.

As described by the author, "The outer third of each vertical rectus tendon was isolated with its superimposed capsule of Tenon, split far back, and shaved off the sclera. This I consider a very important point because in this way the fibrous attachment is included which will hold a stitch from slipping out. If the cut is made back of this point, the stitch will slip out along the parallel tendon fibers, unless tied so tightly as to cut itself out by necrosis.

The externus tendon was next isolated freely, *bared of its capsule* and divided lengthwise into three portions of equal width. The two lateral ones were then cut out free, well within the

fibrous portion of their junction with the muscle tissue, for exactly the same reason that the vertical recti were shaved from the sclera.

The object of the above procedures was to permit a good overlap with the vertical recti slips, without undue tension on the stitches.

The central tongue of the externus was then shortened by my double hitch method, as described in my paper before the Ophthalmologic Section of the A. M. A. at Detroit in 1916. This was done in hopes of relieving some of the tension on the sutures, as well as partially correcting, in itself, some of the squint.

The upper section of the externus was then united to the transplant from superior rectus, by a mattress suture inserted as shown in the sketch. Then the lower section to inferior rectus was similarly united to the transplant for the inferior rectus. Conjunctiva then sutured.

The internus was not touched because I wished to prove positively that anything gained in position or outward rotation was due entirely to the transplant."

It will be noted that O'Connor exposed all three muscles, suturing the conjunctiva over them when the steps of the operation were completed, thereby differing from Hummelsheim, who advised operating within Tenon's capsule, to avoid undesirable adhesions.

Last year, Luther Peter reported a successful case in which, instead of turning forwards the upper and lower thirds of the externus, the entire muscle was advanced by a firm whip stitch suture, after severing the tendon at its attachment. The excess tendon was then split, the upper half being carried forward and upward and attached to the outer half of the superior rectus, and the lower half in a similar way united to the outer half of the inferior rectus. Peter claims that the nutrition of these tendon segments will be better preserved by this method and tendon will be united to tendon, by which a firmer union will be formed with less danger of the stitch cutting through.

Employing this latter method, or rather with its employment in mind, for the absence of the inferior rectus muscle prevented its inclusion in the scheme of the operation, at the January meeting of the Wills Hospital Society a year ago, I presented a case of congenital hypertrophia in a young man with marked facial asymmetry, the left side of the face being under developed. With

the left eye fixing in the horizontal plane, the right eye deviated strongly upward. Downward and outward motion in the right eye was abolished, but the eye could be moved downward and inward to a certain extent by the superior oblique. All other movements of both eyes were normal. On account of the absence of action of the inferior rectus, transplantation of muscle fibers from the internal and external recti upon the inferior rectus was decided upon. A curvilinear incision parallel to the corneal limbus was made, laying bare the insertions of these three muscles. The inferior rectus was found to be absent, except for a very rudimentary portion of muscle fibers found at the site of the usual insertion of this muscle into the globe. The lower halves of the externus and internus were sewed into position upon this stump. A free tenotomy of the superior rectus was done. Care was taken to bring the capsule of Tenon forward as much as possible by double single stitch sutures. Healing was prompt. At the end of two weeks the eyes were on the same horizontal plane, there was a left hyperphoria of ten degrees, and an esophoria of twenty degrees at five meters. (No measurements could be made prior to operation on account of the high degree of the deviations). The improvement in this case has continued. Downward motion has still further increased and lateral motion has been in no wise impaired by the partial transplantation of the external and internal recti.

The field of partial and complete transplantation of ocular tendons in overcoming paralysis of ocular muscles has been strangely neglected by ophthalmologists, and a more widespread trial of the procedures advocated should certainly be made. A careful perusal of Jackson's chapter on Operations upon the Eye Muscles, in Vol. I of a System of Ophthalmic Operations, and particularly of that portion which has to deal with "operations to enable one muscle to take up the functions of the other," is strongly recommended to all who have not given it due consideration. Such surgical procedures should be peculiarly applicable to paralyzes of long standing and to certain cases of strabismus, traumatic and of congenital origin, the latter being by ordinary methods of advancement and tenotomizing often almost impossible of cure. Naturally the surgeon will be slow in recommending any surgical measures in paralytic cases in which there is hope for correction by therapeutic measures or by the lapse of time. In many cases of congenital strabismus the operator will be often compelled to modify the measures he may have intended to em-

ploy by the conditions he finds present, for my experience has been that in many of these cases the deviation in the ocular axes has been occasioned by structural peculiarities in the musculature, the existence and nature of which it is impossible to determine until they are exposed by the operation.

## BIBLIOGRAPHY.

- Giesler. Inaugural Dissertation, Rostock, 1910.  
Motais. Communication a l'Académie du Médecine Nov. 8, 1898.  
Communication a la Soc. de Chirurgie, Nov. 9, 1898.  
Dransart. Annales d'Oculistiques Vol. 137, 1907, p. 487.  
Hummelsheim. Transactions of 34th Ophth. Congress at Heidelberg.  
Ibid. Arch. f. Augenhk'd. 1909. Vol. 62, p. 71; Vol. 66, p. 57. 1910.  
Stuelp. Klin. M. f. Augenhk'd. April 1912. p. 469.  
Harris, Pa. Med. Journal, April, 1916.

## CAPSULOMUSCULAR ADVANCEMENT WITHOUT INCISION.

S. LEWIS ZIEGLER, M.D.

PHILADELPHIA.

Simplification of technic is the order of the day in all surgical procedures. It was this thought that impelled me to modify the operation that I presented before the American Ophthalmological Society in 1914, entitled "A New Operation for Capsulomuscular Advancement Combined with Partial Resection."<sup>1</sup> I have simply omitted the resection of the muscle and eliminated the incision through the conjunctiva, thus making the operation one of tucking the muscle or as I prefer to call it of "crumpling," since the distribution of the wrinkles in the three superimposed tissues, muscle, capsule and conjunctiva, suggests this appearance.

It was my good fortune to see many advancement operations performed by De Wecker in the early nineties, and somewhat later to observe the work of Knapp, who greatly improved on De Wecker's technic by employing Critchett's method of introducing the sutures. This latter operation proved most successful among the many readjustment procedures that were undertaken to restore the lost function of overcorrected eyes, that were so common in those early days of radical complete tenotomies, accompanied as a rule by too free division of Tenon's capsule and the subsequent protrusion of the globe through the capsular breach. It was on the basis of a similar principle that I planned my original operation (1) "Muscular Advancement with Partial Resection and Conjunctival Suture," which I later modified for the sake of increased efficiency under the title of (2) "Capsulomuscular Advancement with Partial Resection; a Single Stitch Method." I now desire to present this much modified operation in its final form as (3) "Capsulomuscular Advancement Without Incision," which I believe will prove to be still more practical because of its greater simplicity.

The essentials of success in advancement of the extraocular muscles, from the viewpoint of my own personal experience, are (1) firm scleral anchorage, (2) "whip-stitch" fix

ation of the muscle margins, (3) equal parallel pull, (4) inclusion of the capsule and (5) single suture removable externally. Firm anchorage must be maintained in the sclera as close to the cornea as possible. Many operators utilize the tendinous insertion of the muscle which they have just resected. This often leaves a thick, unsightly bunch at the seat of operation, which sometimes undergoes proliferation. The muscle must be firmly fixed, without causing strangulation, displacement or tearing of its fibers. "Whip-stitch" fixation of each muscle margin yields the best result of any method so far attempted, and permits equal traction on each margin in order to secure a straight parallel pull. Advancement of the capsule along with the muscle always increases the effect, and where the muscle is lame and restricted in its action and thus fails to draw the eye beyond the median line, proves to be the ideal method of restoring its lost function. It is especially useful in cases requiring "readjustment." A single suture will eliminate confusion and promote simplicity and efficiency. If this suture can be applied externally it will prove more accessible for removal and further simplify the procedure. It is better, however, to insert this suture without incision, as suggested by Troussseau, but with an improved technic, since he confesses that his "simple suture" often slips.

The problem of advancement always presents some minor and collateral complications, that require antecedent adjustment in order to make the major procedure a success. If, therefore, indications should demand it, the pull of the opposing muscle should be weakened either by (a) division of capsular adhesions when present, (b) stretching of the tendon or of Tenon's capsule, (c) bilateral partial tenotomy or (d) complete tenotomy where the opposing muscle has undergone contraction. The small amount gained by these procedures is then supplemented by the advancement operation, which can be adjusted to whatever degree is necessary by measurement with the Greek cross test object, when binocular vision is present, the surgical knot being tightened or slackened before tying, according to the indications noted. Whether much or little is gained by these preliminary and collateral measures, such conditions, if uncorrected, naturally become handicaps that prevent a good result. The advancement alone should yield about 45°.

OPERATIVE TECHNIC.—*First Stage*:—The muscle is grasped through the overlying conjunctiva by fixation forceps about 12 mm. back of the sclero-corneal junction. One needle of a double armed suture is entered through the conjunctiva and muscle at its lower third. It is then passed toward the sclera and made to emerge through the conjunctiva at the lower margin of the muscle. The same maneuver is then repeated by entering the needle 2 mm. back of the first puncture and again emerging just back of the first exit, thus forming a “whip-stitch” on the lower margin of the muscle.

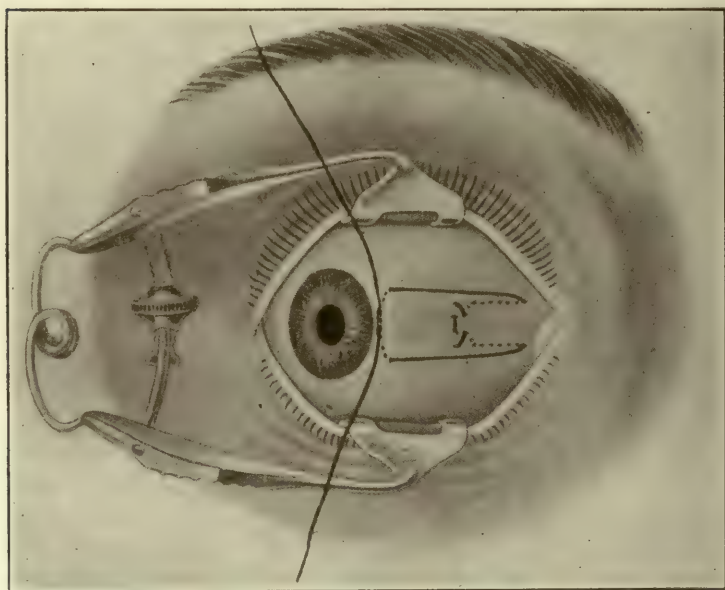


Fig. 1. Single suture entered (1) in “whip-stitch fixation” of each muscle margin, (2) carried backward under Tenon’s capsule and (3) brought forward to a “scleral anchorage” near limbus.

The second needle of the double armed suture is now passed in like manner through the muscle at its upper third and again entered 2 mm. back of this point, thus forming a second “whip-stitch” on the upper margin of the muscle. This furnishes a central restraining thread and two lateral binders that will grip the margins tightly without slipping or tearing the muscle fibers. (Fig. 1).

*Second Stage*:—Each needle is now separately carried backward beneath Tenon’s capsule on a line parallel with each muscle margin and passed out to the conjunctival surface

about 6 mm. farther back than the "whip-stitch" (or 18 mm. from the limbus). If desired, a small double perforated plate of celluloid or metal may be threaded onto the silk suture, to prevent it from cutting through the tissues when forward traction is exerted to "crumple" the muscle.

*Third Stage:*—The lower needle is now carried forward and entered vertically through the conjunctiva 2 mm. back of the limbus and 5 mm. below the horizontal plane, dipping firmly into the sclera and emerging 2 mm. below the horizontal plane. The same maneuver is then repeated with the

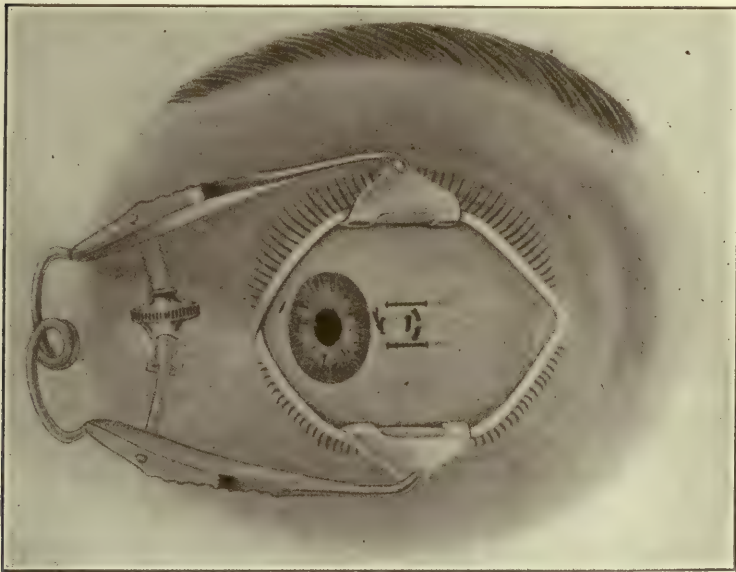


Fig. 2. Suture drawn taut and knot firmly tied. Two parallel threads, knot and whip-stitch are left exposed and easily removable. Tissues are crumpled and held flat.

upper needle and suture which should dip into the sclera 5 mm. above the horizontal plane and emerge 2 mm. above the horizontal plane, thus leaving a free, intermediate space of 4 mm. for tying the two ends of the suture. It is well to keep these two suture ends sufficiently far apart to maintain a parallel pull and allow room for tying. (See Fig. 1.)

*Fourth Stage:*—The two free suture ends are now tied in a primary surgical knot which is steadily and firmly drawn taut until the squint is slightly overcorrected (about 5°). The effect can be measured by the Greek cross test object and

graduated as desired, if binocular vision is retained. The secondary knot is then tied. (Fig. 2.)

All conjunctival rugae should be smoothed out with a silver spatula before finally tying the knot. To prevent distortion of the tissues the two lines of suture should be inserted as nearly parallel as possible and should firmly hold the conjunctiva and subjacent tissues perfectly flat against the sclera, somewhat like a mattress suture. The muscle, the capsule and the conjunctiva are thus superimposed, fixed and drawn forward to the point of anchorage.

To secure a permanent result the suture should be allowed to remain in situ for at least ten days, or until firm union has occurred. If removed before this time relaxation of the muscle may take place. As the knot, "whip-stitch" and parallel lines of suture are exposed on the conjunctival surface, their removal is easily accomplished. The central restraining thread of the "whip-stitch" should be cut first, while the knot is grasped with forceps and drawn out with a steady pull. No. 1 braided black silk is preferably used, boiled in equal parts of paraffin and vaselin.

The eye is kept bandaged for a few days. If there is pain, inflammation or edematous swelling, the dressing must be removed and ice pads applied continuously until relieved. The corrugations or thickening of the tissues caused by the "crumpling" will soon smooth out, but the redness often persists for a month.

REPORT OF CASES.—Case 1.—Mrs. J. L., aged 28 years, consulted me on April 22, 1918, with vision of O.D. 20/50, J 3; O.S. 20/30 pt. J 1. There was pronounced divergent strabismus, O.D. turning out about 60°, with inability to converge beyond the median line. Patient believed the condition to be congenital.

Operation: On May 15, 1918 both external recti were divided and traction made above and below with the tenotomy hook, but this only partly straightened the eyes. and O.D. still failed to pass beyond the median line. The internal rectus of O.D. was then grasped by forceps and with a double armed single suture, a "whip-stitch" was made on each margin of the muscle to fix it. This suture was carried back thru capsule and conjunctiva and brought forward to the sclero-corneal junction, where it was anchored securely in the sclera. A primary surgical knot was tied and traction made to pull

the muscle and capsule forward, until the tissues "crumpled" and yielded an overcorrection of about  $5^\circ$ . The suture was removed on the tenth day. Convalescence was prompt and uneventful. Refraction under cycloplegia yielded:

O.D. 15/200; S + 2. D.  $\ominus$  C. + 1. D. ax  $105^\circ = 20/20$  pt.

O.S. 15/200; S + 1.75 D.  $\ominus$  C. + .75 D. ax  $15^\circ = 20/20$ .

The result of this advancement operation has been permanent during the past three and one-half years, both as to orthophoria and as to restoration of convergence power in the right internal rectus. (Figs. 3, 4 and 5.)



Fig. 3. (Case 1.) Divergent squint,  $60^\circ$ , corrected. Right eye now rotates beyond median line, to the left.

Case 2.—Miss A. W., aged 20 years, was first seen by me on April 30, 1920, suffering from marked convergent strabismus, O.S. turning in about  $65^\circ$  and slightly hypertropic. Excursion was limited to the median line. She was wearing a high correction for hyperopia, and the eyes were slightly less convergent when glasses were worn. Vision of O.D. 20/20 pt., J. 2; and of O.S. 1/200. O.S. had been injured at 7 years of age by a tin can, which cut the cornea and iris and probably

bruised the lens. There was adherent leucoma on the nasal side and a slight opacity of the anterior surface of the lens.

Operation:—On May 11, 1920, capsulomuscular advancement of external rectus O.S. was made by suture alone without incision, which brought the eye almost into position. This was supplemented by making a small conjunctival incision over the internus, inserting a tenotomy hook and stretching the muscle above and below, as recommended by Panas and



Fig. 4. (Case 1.) Eyes rotate well to the right.

Fox. In doing this a small capsular adhesion was found above and divided, thus permitting the eye to return to normal level. As the external movement of the globe was still somewhat limited, a partial tenotomy of the internus was performed which greatly improved excursion.

A bandage was worn for two days. The "crumpling" of the muscle was evident for one week, but there was no reaction. The redness, however, persisted for one month. The

suture was removed on the twelfth day. Under cycloplegia the following error was found:—

O.D. 20/200; S. + 3.50 D.  $\ominus$  C. + .62 D. ax.  $105^\circ = 20/15$  pt.

O.D. 1/200; S. + 1.75 D.  $\ominus$  C. + .37 D. ax.  $90^\circ = 20/100$

These were ordered with a slight reduction in the right spherical.

Examination on December 8, 1920, showed that the movement of the eyes was excellent in all directions, and that excursion of O.S. to left side had been fully restored. There remained an esophoria of P.  $5^\circ$  base out. The result of this



Fig. 5. (Case 1.) Eyes looking straight ahead. Orthophoria.

operation has been permanent for eighteen months. (Figs. 6, 7 and 8.)

A review of this case shows that there were three difficulties to be overcome:— (1) long continued overconvergence from suppression of the image in O.S., (2) contraction of the internal rectus and capsule over it, which required stretching and partial tenotomy to restore excursion beyond the median line and (3) adhesion of the capsule to the globe at the upper margin of the internal rectus causing hypertropia.



Fig. 6. (Case 2.) Convergent squint,  $65^\circ$ , corrected. Left eye now rotates beyond median line, to the left.



Fig. 7. (Case 2.) Eyes rotate well to the right.

One of the chief advantages of capsulomuscular advancement without incision is that both capsule and muscle are brought forward together, instead of being separated by the sweep of the tenotomy hook. The question has been raised as to how an unexposed and undisturbed capsule and muscle can unite in a new position on the globe without incision or scarification of the tissues involved. It must be evident that the "crumpled" muscle and the pressure of the suture against the superimposed tissues in a new position will cause plastic



Fig. 8. (Case 2.) Eyes looking straight ahead. Slight esophoria ( $5^{\circ}$ ) when glasses are omitted.

exudate to be thrown out, just as in the De Wecker-Knapp capsular advancement, or in any other advancement, since union always occurs on the bulbar surface and not at the cut end of the muscle. We do not scarify the surfaces in any of these methods of advancement, but depend on severance of the tissues by the tenotomy hook. Displacement of the tissues by "crumpling" will cause the same effect.

Capsulomuscular advancement has a distinct advantage in

all cases where the excursion is limited, or where the muscle is parietic, or where "readjustment" is required. This single stitch method without incision is an improvement on my former method of partial resection, and in my practice has supplanted all other operations for muscular advancement. It possesses, therefore, all of the advantages which I claimed for the former method, with none of its disadvantages:—

1. Firm scleral anchorage.
2. "Whip-stitch" fixation of each muscle margin.
3. Splint like support of the muscle by parallel lines of suture laid across the superimposed conjunctiva, capsule and muscle, all of which are advanced together.
4. Straight traction on both muscle edges.
5. Graduated control while the suture is being tied.
6. Single suture, removable externally.
7. Tucking or "crumpling" of the muscle without an unsightly knuckle.
8. Reposition of the globe through advancement of the capsule.
9. Globe cannot slip farther back if suture yields, as is possible in resection.

#### BIBLIOGRAPHY.

1. *Annals of Ophthalmology*, Oct., 1914.

#### DISCUSSION OF DR. POSEY'S AND DR. ZIEGLER'S PAPERS.

DR. E. C. ELLETT, Memphis, Tenn.: From the large number of methods of operating on the eye muscles that are in vogue, and from the fact that this number is constantly being added to, one is justified in drawing the conclusion which is obviously drawn from such circumstances, that none of the methods give entire satisfaction to all who attempt them. There are three general plans in use by which a muscle may be shortened, or, in effect, shortened. These are, first, an advancement, as Dr. Posey has described, in which the muscle is severed from its attachment to the ball and reattached at a position in advance of its former attachment; second, by a resection, in which a piece of the muscle is cut out, and the cut ends are attached, so that the insertion of the muscle into the sclera is the same as before; third, the muscle may be folded, or tucked, as described in Dr. Zeigler's paper. Actually it is shortened, but no part is removed.

If a muscle is advanced, that is, if it is cut loose from its attachment to the eye and reattached at some point in advance of the normal insertion, it is well known that the new point of action is not the new point of attachment to the ball of the eye, but the muscle heals firmly to the ball from that point back to the site of its former attachment,

and here it leaves the ball, so to speak, and this remains the point of attachment to the eye on which it exerts its function. As far as the result goes, then, one might as well attach the muscle anew at this point. Since it is so much easier, and safer and surer to pass sutures through the stump of the tendon and get a firm hold than it is to dip them into the sclera and get a firm hold, it has long seemed to me advisable to remove a piece of the muscle and attach the cut end to the stump of the tendon. This method, namely, that of resection, has another advantage, in that it is very easy to place the sutures near the center of the tendon stump, and thus avoid any upward or downward rotation of the eye which might follow if they were not placed so as to draw the muscle forward exactly in its plane of action.

Of the resection operations, the one devised by Reese is my personal preference. In placing the sutures, it should be remembered that they have to be removed, and therefore the method of which Dr. Posey speaks, of placing the loop first and then bringing the ends out through the muscle and conjunctiva and tying them on the conjunctiva, is advisable. All sutures should be so placed. In the Worth operation they are so difficult to remove, that many have given up the operation on that account. In this connection, the suture plates, as suggested by Dr. Savage and Dr. Wiener, have not received the attention which they deserve. They are especially helpful when it comes to removing the stitches. Catgut would overcome this objection, but if you use a catgut which you can be sure will stay as long as you want it, it will probably stay a good deal longer, and cause an objectionable red lump until it is absorbed.

It is a mistake to claim, in any of these operations, as is often done, that the immediate result is the final result. There seems to be always a stretching of the tissues that may vitiate the result, unless an immediate overcorrection is obtained.

Dr. Posey's plan of early exposure of the unoperated eye is commendable. Some writers speak of keeping both eyes bandaged for a week, which seems wholly impossible with many children. The only possible advantage of this is to secure immobility of the eye while the muscle is growing fast to its new attachment, and there are other methods of securing this without keeping both eyes closed. One is to pass a suture, pulling the operated eye in or out. Another is Gifford's suggestion of passing a suture through both lids and the tendon of the unoperated muscle. Another is Wilkinson's ingenious plan of suturing a lead plate on the muscle, so that it lies on the conjunctiva between the cornea and the canthus. The usual way is by a tenotomy of the opposing muscle.

I am sorry to say that I have no experience with the operation of tendon transplantation.

DR. L. WEBSTER FOX, Philadelphia: Dr. Ziegler's admirable paper presents many opportunities to discuss the already much discussed topic of muscle surgery, which has engaged the attention of ophthalmic surgeons for many years. The possibility of the proper solution of the problem seems yet to be in the distant future.

The number of surgical procedures suggested and devised for

squint bids fair to rival the cures for rheumatism, and, to carry the comparison further, appear to be of about the same value. Dr. Ziegler has dug for himself a pitfall in the presentation of his original operation in 1914, for it has shown shortcomings, even in his own hands, requiring modification at a later period, and still later, another modification, which he proves to his own satisfaction to be perfect by the citation of two cases in which a desirable result was obtained. Any comment that may follow, that might fail to be enthusiastic, can only be attributed to a failure to observe the ordinary rules in the presentation for discussion of cases and operations. Two cases with a good result in both constitute a one hundred per cent cure, but still fail to carry sufficient conviction concerning the merits of the operation, and, while very well described, is only the assembling of the several good features of other operations in order to obtain the tucking to the best advantage.

I am not very enthusiastic over any of the tucking operations; they are always being improved by their creators.

In the first case presented by Dr. Ziegler the patient had a divergent squint and poor vision. After operating, her vision was brought by careful refraction to normal and the patient had a good result. This is an important consideration, although Dr. Ziegler seems to belittle what he calls "some minor and collateral complications that require some antecedent adjustment in order to make the major procedure a success." Most of these have to do with the releasing of opposing bands and contracting muscles, but it is more than likely that he includes the correction of the ametropia in theory, although carefully considering it in practice.

The concrete case afforded by Dr. Ziegler as an evidence of the value of his type of advancement operation in convergent squint, seems on careful analysis to possess features that admit of several interpretations. The patient was seven years of age at the time the injury was received that reduced her vision, and was attended by convergent squint in the damaged eye. It is assumed that the squint developed after the accident. If this is correct, then she had previously properly developed her functions of binocular single vision, binocular fusion, and binocular fixation and a centric macular region. As a corollary to this, her extraocular muscles were anatomically normal. These apparently trifling features are of such importance, that they make or mar any muscle operation. At the time the patient consulted the surgeon she was twenty years old, and the note states that the eyes were straighter when the glasses were worn, but that the excursion of the left eye was limited to the median line. In repose the eye turned in and slightly up.

The treatment consisted of a capsulo-muscular advancement on the external rectus of the left eye by suture alone without incision—stretching and partial tenotomy of the internal rectus of the same eye, with the releasing of the capsular adhesion.

In a recent paper by A. S. and L. D. Green of San Francisco, California, in the *Journal of the American Medical Association* for September 24, 1921, the results of two hundred and sixty cases were tabulated, and they reported only seven per cent of cures by nonsur-

gical treatment. This is not very great, and offers encouragement to those of us who are given to surgical treatment. Any change would seem to be an improvement. In a questionnaire sent to the ophthalmologists of the country, they learned that out of two hundred and thirty-five replying, only one hundred and fifty had a definite method for determining when to operate for squint. But only eight gave a method that would enable them to decide whether to operate at once or to try nonoperative means. On the whole, the answers indicated an indefinite and vague method of handling the condition in practice. There seems to be one point on which all agree, and that is that the earlier in life the treatment, whether it be surgical or nonsurgical, the better will be the result.

It is very difficult to attribute always the results that accompany a procedure to that particular procedure; and in this second case of Dr. Ziegler's it would seem that the surgical procedure that produced the result was the tenotomy and the release of the capsular band, and not the advancement. An eye that has once been normal will assume its coordinating functions rather readily when the obstacles are removed; but an eye that has been divergent or convergent from three and a half years of age, and then is presented at the age of twenty for a surgical treatment, often fails to give the slightest encouragement to the best and most conventional surgical procedures. A muscle that has never been developed will not partake of the functions of muscle structure in general, no matter how it is shortened or tucked. The same is true of paralyzed muscles. Normally, as is well known, the externi are much weaker than the interni. The interni show in youth, in nearly all cases, a tendency to upset the muscle balance and overcome the externi. The great incidence of esophoria proves this. Therefore, the interni must engage the greater share of the surgeon's attention.

There is really, after all, but one muscle operation. That is von Graefe's tenotomy, which consists of a vertical incision over the internus muscle, the cutting of the muscle and the covering up of the wound with conjunctiva. The advancements owe their success to the accompanying tenotomy. The broad capsular advancement, using a broad clamp, which I have employed so extensively, is the only one I can conscientiously recommend. It is safe and it is as reliable as any. On the other hand, the only cases in which I have seen infection have been those in which the tucking operation has been performed. It is only fair to state that these operations give the best results in the hands of their creators, their judgment seeming to be able to sense points in the selected cases that make them especially adaptable to that kind of surgery.

The operative procedure devised by Dr. Ziegler is to be commended for this feature: it does not mutilate an already weakened and impoverished muscle; but the irritation attending this manipulation and tying of the suture produces adhesions, the contraction of which induces shortening, whenever it is produced by these operations. In this particular case, the probability is very great that the result was due to the tenotomy and the releasing of the capsular adhesion.

However, the subject of muscle surgery has not reached the limits of its development, and it is only by the careful record of cases of this character that an experience, to use a life insurance term, is built up that will ultimately clarify the situation.

DR. LOUIS F. LOVE, Philadelphia: I want to compliment Dr. Posey and Dr. Ziegler for their most excellent papers, as surgery of the eye muscles is always a most interesting and important study.

In the operation for strabismus, although many different methods are used, in the majority of cases the results are successful. But I feel that you will agree with me that the scientific management of these cases, at the present time, is by no means perfect.

I must confess that in the past twenty-five years I have performed double tenotomy in concomitant squint in many cases, being careful to confine the tenotomy to the tendon, and as far as I am aware, except in two cases where secondary deviation has occurred, the results have been most satisfactory.

I have performed many advancement operations along with tenotomy but usually postponed the tenotomy until a later date.

The operation for advancement which I have usually employed has been the Swanzy or a modification of Landolt. But scleral sutures I avoid. I invariably use catgut and insist on both eyes being bandaged for six days and the patient remaining in bed.

Of tendon transplantation I have had no experience.

DR. JOS. L. MCCOOL, Portland, Oregon: Dr. Posey's statement that "probably not any one procedure is universally applicable on account of the idiosyncrasies in the cases themselves, such as anomalous insertion of the muscles into the globe, etc.," would seem to permit of a short discussion of a phase of the subject, the importance of which cannot be too greatly emphasized. I refer to the difficulty in differentiating between those cases of nonparalytic squint which are due to defective fusion sense or ametropia, and those which are dependent upon a faulty insertion or a structural defect of a muscle. That this is sometimes hard to do there can be no doubt. As my experience increases, I am convinced that more cases of squint are due to structural and insertional anomalies than was formerly thought to be the case. This opinion may be based on premises which are insufficient and perhaps unscientific, but having been impressed with the relatively few cases which have been improved by orthoptic training, I am inclined to believe that many a so-called functional squint is in reality due to a weakness of one or more muscles, either one of the vertical recti or the obliques. This very easily disrupts the coordination of two eyes. I am sure this type is quite apart from the squints which are due to manifest paralyzes of one or more of the ocular muscles present from birth, and are comparable to a hyperphoria due to a paresis of one of the vertical muscles which develops frequently into a hypertropia. Much information may be gained by observing the action of the two eyes when following a point of light carried in the six cardinal directions of the gaze combined with the use of the cover test. The tropometer should be used when possible, but I cannot say that it gives much helpful information unless the rotations vary greatly. With an operation such as Dr. Posey describes applied to the proper muscle or muscles after all conservative

treatment has failed, we should be able to operate at an earlier age. I see much less objection to shortening an ocular muscle in order that fusion may be more readily trained in a child as young as five years if nonoperative measures have been tried and it has been established that they will not avail, than it would be to stand idly by and watch an eye become amblyopic in spite of anything which we may do to prevent it.

I am sure that Dr. Jackson is right when he advises us to plan an operation in advance, and not be governed by conditions as we find them under stress of operation. If we study our cases thoroughly, determine how many degrees we want to correct, apply that operation which we have learned to do well and with whose limitations—and they all have their good and bad points—we are familiar, I am sure that our successful results will increase. My preference is for the O'Connor advancement operation. I never do a complete tenotomy on a child and rarely on an adult. If on the latter the contracture of the internus seems to warrant it and I desire a cosmetic result only, I have not hesitated to advance the externus, lengthen the internus by a double jigsaw tenotomy and tenotomize the inner two-thirds of both superior and inferior rectus muscles, in order to control the secondary abducting effect of these muscles. I would do this, of course, only on an amblyopic eye and in those cases which refuse operation on the good eye.

DR. DAVID W. WELLS, Boston: It seems easy to get good results, but it seems difficult to determine what is the best method; therefore we must demand the presentation of statistics of all cases operated by a given method. In 1914, in connection with Dr. Sternberg, I reported sixty-five operations by my modification of the Worth advancement. The data given were the amount of deviation in perimenter degrees, age of onset, the refraction under cycloplegic, the glasses ordered and how long worn, the effect of glasses on the deviation, the fusion training if given, then the operation and the treatment of the antagonist, the final result in degrees or prism diopters, and then whether or not stereoscopic vision was secured. We have got to put down our results in some definite form to arrive at any definite conclusion as to the best operation.

With regard to the statement of Dr. Ellett that the advanced muscle becomes adherent to the old attachment of the muscle, I have one case on which a second operation enabled me to determine that this is not true. A case of esotropia of  $24^{\circ}$ ; the first operation of advancement was insufficient by  $10^{\circ}$ , so the operation was repeated on the same muscle and it was found adherent to the sclera only 3 mm. from the corneal margin. I do not believe that in a properly performed advancement operation the "muscle becomes glued down to the former insertion."

DR. H. W. WOODRUFF, Joliet, Illinois: I wish to relate my experience with a case of bilateral abducens paralysis—one of those extreme cases, comparatively rare, in which there was such a high degree of convergence that the corneal were partly hidden behind the inner canthi.

This man presented himself at the Illinois Charitable Eye and Ear Infirmary last Winter, with a history of having suffered a severe head

injury seven years previously. He had been unconscious for hours and the paralysis was present when he recovered consciousness. However, in addition to this very definite history as to the origin of the paralysis, he had a positive Wassermann, and a neurologic examination disclosed a very definite condition of tabes. However, as there was no possible chance for recovery, on account of the duration of the paralysis, I operated for the relief of his strabismus. Having had four or five cases of muscle transplantation in unilateral abducens paralysis and having secured better results with this method than with any other, I adopted it in this case with very satisfactory results.

In the first operation, I not only transplanted the outer halves of the superior and inferior recti tendons to the insertion of the external rectus; but I also did a very extensive resection of the internal rectus, which resulted in some divergence. When I came to operate the other eye, I omitted the resection, doing the transplantation as in the first eye and simple tenotomy of the internal rectus, which gave a perfect cosmetic result. This operation differs from the one shown by Dr. Posey, in that the tendon flaps are fastened by sutures directly to the insertion of the external rectus, without making flaps of the externus to unite to the tendon flaps of the superior and inferior recti.

DR. WM. CAMPBELL POSEY, Philadelphia (closing discussion): I took the liberty of bringing this simple form of advancement operation before this meeting, in order that it might be given full publicity, and because its excellence so commended itself to me that I should like others to give it a trial. When I first started in practice, I followed the old advancement operation as laid down by Swanzy and later by Worth. The O'Connor method was given full trial, but the results of none of the three equal those obtained by the twin single stitch method, which I have used exclusively for the past three years. In the tendon transplantation operation, I prefer the plan followed by Peter, O'Connor's procedure, in my opinion, being unnecessary. While cases suitable for this operation are limited, I do think they should be given wider trial, for it is applicable especially in congenital strabismus.

DR. S. L. ZIEGLER, Philadelphia (closing discussion): The operation I have presented should not be considered a panacea for every muscular deviation that might occur, but should cover the field that I have pointed out. Where there is contraction of the opposing muscle or capsular adhesions, I do not see how you can plan in advance what operation you are going to perform. I think it wiser to investigate the accessory conditions by making an incision over the opposing muscle and ascertaining whether it is too short or whether there are capsular adhesions. I think capsular adhesions have not received the attention they deserve, because they interfere with many of these cases, and cause failure where our operations would otherwise prove successful.

With regard to the patient with convergent strabismus, there was no question about this case being one of suppression of the image from corneal and lenticular traumatism, and no question about a slightly improved action gained by the wearing of high hyperopic

glasses. But this improvement was limited, since the eye did not possess useful vision, and glasses did not correct the deviation. It is a lame lens and will always have poor vision. The fact remains that before operation there was an overconvergence of  $65^{\circ}$ , with limited excursion, and that since the operation the eyes have worked together satisfactorily. In the case of marked divergence, orthophoria was established at once and has been maintained during the past three years. The experienced clinician should know that refraction alone will not correct divergent squint, but that glasses may hold the eyes after a successful operation.

As to supplementary work, I do not see how that is going to be eliminated. I do not believe that Dr. Fox can gain 60 to 65 degrees from advancement alone. We have to supplement it by investigating and correcting those conditions which are coincident. We must definitely know what else is interfering. I think it wise in the majority of cases to release a contracted muscle that is opposing. The fact that the advanced muscle did not work quite as "fluently," so to speak, caused me to do a partial tenotomy of the opposing muscle, I did that to ease up the contracted internus and not to increase the action of the externus; because, had I not already secured my result from the capsulo-muscular advancement, the partial tenotomy would not have helped materially. As a partial tenotomy will correct only from 10 to 20 degrees, it is selfevident that the advancement operation must have yielded about  $45^{\circ}$ . But in addition to this, and of equal importance, was the restoration of the power of excursion across the median line.

The statement is true that I have twice modified my advancement operation, but only in nonessential details. The underlying principle remains absolutely the same. I first changed from scissors to punch and later omitted excision of the muscle fold and incision of the conjunctiva. The essential factors of "whip-stitch fixation and sclera' anchorage" are still retained. Simplifying an operative procedure should be considered a mark of progress and not a "surgical sin."

## PRISMS: SHOULD THEY BE PRESCRIBED FOR CONSTANT WEAR?

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In discussing the question of the prescription of prisms to be worn constantly, the writer has chosen to answer it in the affirmative. This position of course, is held only in certain cases, which will be defined later. Teachers and authoritative text-books have insisted that prisms worn constantly not only fail to improve the condition of the eyes, but actually increase the phoria. Dr. Casey Wood says, "Prisms worn constantly tend to increase the deviation, and their use is not generally advisable." The charge has also been made that the prescribing of prisms is unscientific. Dr. J. M. Banister says in the *American Journal of Ophthalmology* for December, 1920, "I am opposed to the use of prisms, bases in, to be worn by the patient, and have not prescribed such for many years: this use is unscientific and tends to increase the degree of the convergence weakness." The writer has chosen this position after prescribing prisms for twenty-six years, during which time he has practiced ophthalmology in his present location, and has observed carefully the results of their use. In earlier years, prisms were prescribed only occasionally, and then not without the feeling that the teachings of practice and authority were being violated. Most of the cases were given a correction for refractive errors only, and if the amount of phoria was large an operation was advised. If the patient returned still complaining of eyestrain which seemed to be due to a strain of the extrinsic muscles, he was given exercise by some one of the various methods.

Prisms are not prescribed in cases of muscle weakness or enervation, nor in operable cases where the phoria is in excess of about five prism degrees, unless an operation is refused. In cases of weakness or enervation of some of the recti muscles, the amount of phoria varies often several degrees from one day to the next, even from one hour to the next. In such cases it is agreed that to prescribe prisms is not at all satisfactory.

There is, however, another condition, often the cause of phoria, which seems to have been overlooked or ignored by teachers and writers. This is an anatomic defect due to the obliquity of the orbit, to a malattachment of the recti muscles to the eyeball, to a slightly misplaced macula, which would have the effect of a malattachment, or perhaps to some other cause. A study of cases in which there is an ethmoiditis, or some other pathologic condition in proximity of the orbit, would lead one to believe that the first of these possibilities is the cause of a large number of cases of anatomic defect. The diagnostic characteristics in this class of phorias, and those which distinguish them from phorias caused by muscular insufficiency, are that the amount of the phoria is constant, the degree is small, being corrected in a large majority of cases by prisms of less than four degrees, and, finally, that there is an entire absence of muscular weakness shown when the muscles are tested separately.

It has been noted that except in rare instances, esophorias of this type do not produce eyestrain, and when corrected the patient experiences no benefit. For this reason, the writer prescribed prisms with bases out very infrequently.

The conditions, then, in which prisms are prescribed for constant wear, has been limited to exophorias and hyperphorias of a small degree, and where there is no convergence insufficiency. It is this type of phoria which will be referred to further in this paper, and for which it is advocated that prisms be worn constantly.

It seems clear that something should be done to give relief to patients suffering from these slight, though troublesome phorias. A hyperphoria correctable by a prism of one-half degree, or an exophoria correctable by a prism of one degree, causes as much discomfort and creates as severe symptoms of eyestrain as an uncorrected hyperopia of one diopter. Operation of course is impossible in such cases of very slight phoria. Experience has shown that exercise for the muscles is unsatisfactory, for the reason that the defect is permanent and the patient will not continue the exercise indefinitely. Furthermore, it appears unscientific to exercise a muscle which is normal, just because of an abnormal condition of the orbit. No one would prescribe exercise to strengthen the ciliary muscle because the eyeball was short. Ophthalmologists insist on the use of midriatics in order to be certain that the

ciliary muscles are thoroughly relaxed to secure perfect correction, yet the same ophthalmologists fail to correct a hyperphoria or an exophoria to relieve the superior or internal recti muscles, or if compelled to prescribe prisms, advocate that the correction be done only incompletely.

It is the opinion of the writer that the solution of the difficulty, and the scientific treatment of such cases, is the constant use of prisms by the patient to counteract the effect of the anatomic defect. The use of prisms is a recognition of the defect and an adjustment to it; exercise is an attempt to overcome the defect by a second departure from the normal, by a burden added to a normal muscle. It has also been charged that the use of prisms is injurious to the eyes, that it increases convergence weakness, and that increasingly stronger prisms are needed. In the type of phorias under discussion, there is no convergence insufficiency. The need of increasing the prism strength is due to the fact that the full correction was not given at the first examination. Dr. John E. Weeks says: "In many cases of exophoria in which prisms are prescribed, the degree of phoria will appear to increase on use of prisms. This is due many times to the relaxation of overstrained muscles, in which case the development of the phoria will cease when a natural balance has been reached."

It is true that patients who have worn prisms for a period of time experience greater discomfort if the prisms are removed, than was experienced before the prisms were worn. This is caused only by the normal muscle attempting to do the overwork which had been done by the prism. The same discomfort is observed if lenses for a hyperopia are removed from a patient after he has become accustomed to their use; yet this discomfort is never used as a basis for argument that lenses should not be used for hyperopia.

In the accompanying tables, a summary has been made of cases which have been under the writer's observance for the past twenty-six years. Only those cases which have returned for a reexamination after an interval of at least a year are recorded. The tables record the case number, the strength of the original prism, the interval to the nearest year during which the prisms were worn, and the strength of the prism last prescribed.

It may be seen that the average change of prism strength is on the use of midriatics in order to be certain that the

average strength of the first prisms prescribed in the 265 cases is 1.53 degrees; the average length of time the prisms were worn is 4.19 years; and the average strength of the last prisms prescribed is 1.57 degrees. Of the 265 cases, the strength of the last prism is increased in 85 cases, decreased in 84 cases, and the first and last prisms are of equal strength in 96 cases.

The average strength of the first prisms prescribed, as shown in the table of prisms base up, is 1.07 degrees; the average length of time the prisms were worn is 3.73 years, and the average strength of the last prism prescribed is 0.9 of a degree. Of the 85 cases, the strength of the last prism is increased in 19 cases, decreased in 35 cases, and the first and last prisms are of equal strength in 31 cases. That there should be any change necessary is due to the likelihood that the exact correcting prisms were often not given. It is difficult to make sure that the recti muscles are thoroughly relaxed. We have recourse to nothing that corresponds to the use of a midriatic for the relaxing of a spasm of the ciliary muscle.

In the table dealing with prisms, base in, Case 81, Mrs. K., wore a two degree prism for eight years, then she was given two degrees for each eye which she wore for three years; she then required six degrees to correct her exophoria. At the time of this last examination it was discovered that she had a chronic ethmoiditis.

Case 199 of the same table, Mrs. A., was given a two degree prism, base in, for each eye. At that time she had a chronic ethmoiditis and ozena. Later, an ethmoid exenteration was done, together with a follow up treatment for her ozena. Four years from the time the first prisms were given, it was found that she had no exophoria. These cases are examples to illustrate the assumption that conditions in the orbit and surrounding tissues cause phorias.

The conclusions drawn from a study of what the writer terms anatomic phorias are, first: the tables show that it cannot be fairly charged that the use of prisms increases the phoria; second, there is no convergence insufficiency which may be increased; third, and finally, the prescription of prisms for constant use is justified and scientific because it is analogous to the prescription of lenses for errors of refraction.

## TABLES OF THE PRISMS, BASE IN

Case No.	First Prism	Years Worn	Last Prism	Case No.	First Prism	Years Worn	Last Prism
1	2	5	1	59	2	2	2
2	1	1	1.5	60	1	1	1
3	3	10	4	61	1	3	2
4	2	3	0	62	1	8	1
5	1	10	0	63	1	7	0
6	1	4	0	64	1	2	1
7	2	8	0	65	1	5	1
8	1	3	2	66	1	6	1
9	2	14	2	67	1	4	1
10	2	5	0	68	1	7	2
11	2	13	0	69	0.5	1	0
12	1	17	1	70	1	1	1
13	1	3	0	71	1	8	3
14	2	18	2	72	2	9	3.5
15	1	8	2	73	2	4	4
16	1	17	1.5	74	1	2	1
17	1	8	0	75	2	2	2
18	1	18	1	76	1	1	1
19	1	3	1	77	1	12	1
20	2	17	2	78	1	3	0
21	2	6	3	79	1	10	0
22	1	20	2.5	80	1	9	1
23	1	2	2	81	2	11	6
24	1	5	1	82	2	10	4
25	1	3	2	83	1	3	1
26	1	16	2.5	84	1	4	1
27	2	7	0	85	1	1	0
28	1	2	1	86	1	7	2
29	1.5	4	2.5	87	1	9	1
30	4	8	2	88	2	4	0
31	6	15	2	89	2	7	4
32	2	14	4	90	1.5	5	2
33	2	2	2	91	2	3	0
34	2	7	1	92	2	5	2
35	1	15	2	93	1	1	0
36	4	4	4	94	1	1	2
37	2	3	1	95	1	8	0
38	1	4	0	96	0.5	4	2
39	4	4	2	97	1	8	0
40	1	9	3	98	1	2	0
41	2	15	4	99	2	4	2
42	2	1	2	100	1	8	1
43	4	14	4	101	4	1	4
44	4	4	2	102	1	4	1
45	2	3	2	103	0.5	2	1.5
46	2	2	2	104	5.5	5	4
47	1	1	0	105	2	6	3
48	1	9	2	106	1	1	0
49	2	2	0	107	1	2	0
50	1	1	0	108	1	5	2
51	1	5	1	109	1	3	0
52	2	4	0	110	2	5	4
53	0.5	8	0.5	111	2	10	2
54	2	7	2	112	1	1	0
55	3	2	3	113	1	3	2
56	2	4	2	114	2	10	1
57	2	13	2	115	4	5	4
58	2	2	0	116	1	2	1

Case No.	First Prism	Years Worn	Last Prism	Case No.	First Prism	Years Worn	Last Prism
117	1	3	0	178	0.5	1	0
118	2	6	0	179	1	2	2.5
119	1	3	1	180	1	1	0
120	2	7	3	181	1	1	1
121	1	1	2	182	1	5	0
122	0.5	3	0.5	183	1	1	0
123	2	7	4	184	1	2	0
124	1	6	0	185	1	2	1
125	1	2	1	186	1	3	1
126	2	3	3	187	2	5	3.5
127	1.5	2	0.5	188	1	1	0
128	2	2	1.5	189	2	2	3
129	2	1	4	190	2	2	2
130	1	9	1	191	3	1	2
131	3	8	4	192	1	2	2
132	1	2	2	193	1	1	0
133	1	9	1	194	3	1	4
134	2	2	2	195	1	4	1
135	1	2	1	196	1	3	2
136	1	4	1.5	197	2	2	2
137	1	3	0	198	0.5	2	0
138	1	3	0	199	4	4	0
139	1	4	1	200	1	3	1
140	1	5	1.5	201	1	2	1.5
141	2	6	1	202	1	4	0.5
142	1	2	1	203	3	1	3
143	2	1	4	204	0.5	4	0.5
144	1	4	0	205	2	3	2
145	4	1	4	206	2	1	2
146	4	3	4	207	0.5	1	1
147	2	8	3	208	1	4	0
148	1	5	4	209	1	2	2
149	0.5	2	0.5	210	0.5	1	0
150	3	4	4	211	1	2	1.5
151	2	3	3	212	1	1	1
152	2	4	3	213	6	2	4
153	4	2	4	214	2.5	2	2
154	1	1	0	215	1	4	1.5
155	1	5	0	216	2	2	1
156	2	5	2	217	1	1	2
157	1	3	1	218	1	2	0
158	1.5	3	1.5	219	2	3	3
159	0.5	3	-0.5	220	2	2	1
160	2	5	1	221	1	2	0
161	1	1	1	222	1	2	2
162	1	1	1	223	0.5	2	0
163	1	6	4	224	1	2	1
164	1	3	1	225	2	3	1.5
165	3.5	4	4	226	1	1	1
166	2	3	4	227	0.5	3	0.5
167	0.5	3	1	228	1	1	2
168	0.5	4	1	229	1.5	3	0
169	1	3	1	230	2	4	2
170	1	2	1	231	1	3	1
171	1	5	1.5	232	1.5	4	1
172	1	6	1	233	1	3	1.5
173	2	1	4	234	1.5	3	3.5
174	1	2	0	235	1	3	0.5
175	0.5	4	1.5	236	1	1	1.5
176	1	2	0	237	2	3	4
177	2	2	2	238	0.5	3	2

Case No.	First Prism	Years Worn	Last Prism	Case No.	First Prism	Years Worn	Last Prism
239	1	3	0.5	253	1.5	2	2
240	1	3	1	254	2	1	3
241	1	1	1	255	1	1	1
242	0.5	1	0	256	1	1	1
243	1	2	0	257	1	2	1
244	1.5	2	0	258	1	1	3
245	2	2	2	259	1	1	1
246	2	1	4	260	3.5	1	1
247	2	2	3	261	2	1	2
248	2.5	1	4	262	1	1	2
249	0.5	3	1.5	263	4	1	4
250	2	2	0	264	1	1	2
251	0.5	2	0	265	1	2	1
252	8	1	8				

The average strength of the first prism prescribed is 1.53 degrees.

The average length of time the prisms were worn is 4.19 years.

The average strength of the last prism prescribed is 1.57 degrees.

Of the 265 cases, the strength of the last prism was increased in 85 cases, decreased in 84 cases, and the first and last prisms were of equal strength in 96 cases.

#### TABLES OF PRISMS, BASE UP

Case No.	First Prism	Years Worn	Last Prism	Case No.	First Prism	Years Worn	Last Prism
1	0.5	1	0	36	3	4	1
2	0.5	2	0	37	0.5	1	0
3	1	1	1.5	38	0.5	1	0.5
4	2.5	15	3	39	0.5	1	0.5
5	0.5	20	0.5	40	1	6	1
6	1	8	1	41	1	1	1
7	1	4	0	42	0.5	2	0
8	1	7	1	43	0.5	1	0.5
9	0.5	2	0.5	44	0.5	4	1
10	0.5	18	1	45	0.5	3	1
11	1	4	1	46	0.5	5	0
12	3	8	1	47	0.5	1	0
13	2	15	1	48	0.5	1	0
14	0.5	14	0.5	49	0.5	1	0
15	2	4	1.5	50	0.5	4	0.5
16	1	7	0.5	51	0.5	2	0.5
17	2	12	3	52	1	1	1
18	0.5	4	0.5	53	1	3	1
19	2	2	0	54	1	2	1
20	0.5	3	1.5	55	0.5	4	1
21	1.5	1	1.5	56	1.5	1	1
22	1	3	1	57	3.5	4	4
23	0.5	1	2.5	58	0.5	4	0
24	0.5	4	0.5	59	1.5	2	2
25	1	4	1	60	3	4	3
26	4	7	5	61	3	1	0
27	0.5	4	0.5	62	0.5	2	0
28	8	7	8	63	0.5	2	0.5
29	0.5	2	0.5	64	0.5	4	1
30	0.5	3	0	65	0.5	2	0.5
31	0.5	4	1	66	0.5	3	0
32	0.5	1	0	67	0.5	2	0
33	2	8	2	68	1	2	0
34	1	1	0	69	0.5	1	0
35	2	6	1	70	0.5	2	0

Case No.	First Prism	Years Worn	Last Prism	Case No.	First Prism	Years Worn	Last Prism
71	0.5	1	0.5	79	0.5	2	1
72	0.5	3	0.5	80	2	1	1
73	0.5	2	0	81	0.5	1	1
74	0.5	1	0	82	1	2	0.5
75	0.5	3	1	83	1	2	0
76	0.5	2	1.5	84	0.5	1	0
77	1	2	0.5	85	1	1	1
78	0.5	2	1				

The average strength of the first prism prescribed is 1.07 degrees.

The average length of time the prisms were worn is 3.7 years.

The average strength of the last prisms prescribed is 0.9 of a degree.

Of the 85 cases the strength of the last prism was increased in 19 cases, decreased in 35 cases, and the first and last prisms were of equal strength in 31 cases.

### DISCUSSION.

DR. H. W. WOODRUFF, Joliet, Illinois: I believe the author is wrong in inferring that most authors on the subject of muscles are opposed to the wearing of prisms. Howe says "The constant use of weak prisms requires no small amount of care and study of the individual case, but with persistence and with patience in the measurements made from time to time, it is certainly possible to prescribe prisms much more intelligently than is ordinarily done. They are not to be discarded with a few trials, simply because they then prove unsatisfactory, or because extravagant claims of the miracles wrought with them cannot be made good. Within certain limits they are really of great clinical value."

Savage, Jackson and many others have also expressed themselves in favor of the practice. While many oculists I know do not prescribe them, Banister, whom Dr. Dean has just quoted, is the only one I can now recall who has gone on record as against their use.

I have heard, but do not know the source of the statement, that Landolt abandoned the use of prisms after he found that one of his patients had worn, without trouble, prisms turned in the opposite direction from that he had ordered. I have known, myself, patients who were able and did wear cylindric corrections in the opposite axis to the one intended; but these are exceptional cases and do not prove anything.

The symptoms of refractive errors and of muscle errors are so nearly the same, that when both are present the refractive error should be first corrected, not that the muscle error may vanish. The whole subject of refraction and heterophoria is a very complex one, and taken in connection with the personal equation of the individual, it is often not so easily solved. The author mentions two cases who had their phorias cured by surgery and treatment directed to the ethmoids. These should not be included with the anatomic cases. I should call these reflex cases.

In the examination of his cases, I believe the oculist should first make a careful note of the history and subjective symptoms. Pain in the eyes, headaches, lacrimation blurring, dizziness, nausea, etc. Then the vision, manifest refractive condition, and condition of the muscles should be determined. Then, depending upon the individual, the ques-

tion of a cyclopegic is decided as well as the final correction, be it lenses, or prisms or both.

The author states that in case of the anatomic type, exophoria of one degree causes as much discomfort as one diopter of hypermetropia. This may be true, as frequently one degree of hypermetropia causes no trouble.

I agree with the author, also, that in this type of case, the wearing of the corrective prism does not cause any increase in the phoria, any more than the wearing of plus lenses causes an increase in the hypermetropia.

I suppose also the general treatment of the patient would have no effect on this type of muscle error. It might, however, have an effect on the subjective symptoms.

I approve of Dr. Dean's paper, and his limitation of the subject to a certain type makes it comparatively clear and less confusing than this subject often is for discussion.

I have a number of patients who are wearing prisms constantly and who cannot do comfortably without them. I have other patients, however, who could not, or did not obtain relief from wearing them. This, however, may be the fault of the examination, some other factor being undiscovered.

DR. LUCIEN HOWE, Buffalo, N. Y.: In all these cases it seems to me the question is does a given eye turn, or tend to turn out of place because the muscles which pull it are too strong, or because the opposing muscles are too weak?

In other words is the heterophoria or heterotropia active or passive. There are three ways of finding that out. The first is with the tropometer; not necessarily the tropometer of Stevens, but what we can all make out of our perimeters. In using that, it is not the number of degrees which the eye turns in or out, but rather the character of that turning which is important. The weakness or strength of a given group is shown rather by its ability to hold the globe firmly in any extreme position or rotation.

The second source from which we can get information is by photographing the rapidity of the lateral motion, in one direction as compared with the rapidity in the other. Any one interested in that will find the details described in my volume on *Anatomy and Physiology of the muscles*.

The third method is by measuring the lifting power in grams of the adductors. The first model for that method is also described in the same volume.

It is now some forty odd years that I have been studying these muscles, and in that time have accumulated a considerable amount of ignorance concerning them. That is because our diagnoses of the conditions are obtained by different methods differently used, and therefore giving different results. These we also express in different terms. It is only by standardizing our methods of measurement and agreeing on a nomenclature which is uniform, that real progress can be made in our knowledge of the ocular muscles, and consequent success in operating upon them.

DR. JAS. M. PATTON, Omaha, Nebr.: I simply want to emphasize

some of the points of Dr. Dean's paper. There seems to have been a feeling among the rank and file of oculists that prisms for constant wear should not be prescribed. This is certainly not true as Dr. Woodruff has so well said. Some of our ablest men have stated from time to time that under certain circumstances prisms were advisable, but Dr. Dean has stated most clearly the indications for and against their use. If we are true to our profession and sufficiently diligent, we can pick out the cases where they are applicable. When this problem was first brought to our attention, we were skeptical, but their use has proved their value, and although I have not seen so many suitable cases, where we did make necessary examinations, we have had good results. I am convinced that if we will select our cases with the care we should, we will be able to recognize symptoms and make suitable correction.

DR. C. W. HAWLEY, Chicago: Dr. Woodruff's remarks on Landolt finding the patient was wearing the prisms placed in the opposite position, reminds of a case in which I fitted prisms thirty years ago, one of my first. She came exhibiting the following symptoms, saying "I see one man on top of another, and a horse and buggy on top of another horse and buggy." I found she had eight degrees of hyperphoria, and sent her over to the opticians with the prescription. I did not see her again for nearly ten years. At this time I found that the optician had, by reversing the base of the prism, put the horse and buggy up so high that it did not trouble her and she had perfect relief.

I presume that no one in Chicago has studied their use more than myself and Dr. Colburn, who gave me my first ideas in regard to their use more than thirty years ago. As to their usefulness, I am sure I could not get along without them, especially in hyperphorias. Sometimes the esophorias and hyperphorias will disappear with their use. Many cases of muscular insufficiencies are due to a nervous element, and not to a functional fault in the muscles. A student at the Chicago University and a woman appeared the same day, having the same error of refraction and muscular imbalance. The first could wear the prisms with relief of the symptoms and the other could not. The latter I afterwards sent to her family physician to care for the nervous element, and he reported she was relieved of the muscular trouble.

DR. LINN EMERSON, Orange, N. J.: There is no doubt that, in the past, the opinion has prevailed among some of the older men that prisms should not be used; just the same as prejudice against a cycloplegic is becoming a thing of the past, the prejudice against prisms is passing. The late Dr. Reber used to say that the proof of the pudding is in the eating. He was an esophoric and a hyperphoric, and as he wore prisms himself he was strong for their use. Ten years ago, it used to give me great pleasure to talk these things over with him, and my views I found agreed with his almost exactly, as with the writer of this paper. The people who are opposed to the use of prisms assume that you measure off your prismatic degree, and then prescribe by rule of thumb, just as they used to believe that those who used atropin fully corrected hyperopia in all cases and the principle, therefore, was all wrong. You must take into consideration your patients' occupation and age, and more than all else the amount of insufficiency they have for near. I have often given prisms for use in near glasses only, and where distance correction is

also required, have given them bifocals with prisms in the pasters only. Such bifocals give relief when no other glasses will. Before giving prisms, careful refraction under a cycloplegic should be made. Furthermore, I have learned to consider a certain amount of esophoria, one to three degrees, as normal, consequently the individual who has orthophoria for distance and exophoria for near will be benefited by prisms, bases in, for constant wear. I can show more, cases than Dr. Dean has named who are wearing prisms with satisfaction. Some come back in two or three years showing an increase of their exophoria, so that the strength of the prisms have to be increased. I think we may have a condition of latent exophoria, the same as we can have a condition of latent hypermetropia, and as we sometimes increase the strength of plus glasses in these hypermetropic eyes, so we must occasionally increase the strength of our prisms in our exophoric cases.

DR. F. G. STUEBER, Lima, Ohio: The last speaker has touched upon a matter that comes to my mind in speaking of occupations. May it not be that the vocational life of the individual is a factor or has some influence. I think there is such a thing as vocational or occupational imbalance of ocular muscles, as we see, for example, in individuals who follow the engravers' or jewelers' trade, or devote much time to microscopic or ophthalmoscopic work, also those who practice monocular vision when using the head mirror. It appears to me as if this were a factor, where they practice monocular vision one or more hours a day, which may disturb the normal muscle balance. If I rightly understood the essayist, he spoke of the use of the prisms chiefly in anatomic or anomalous defects and peculiarities. We agree that we aid these patients with therapeutic measures where there is faulty innervation; nevertheless, many individuals derive much benefit and comfort from the constant use of prisms.

DR. H. B. LEMERE, Omaha, Neb.: Dr. Dean is to be congratulated on the care with which he has compiled his statistics. I am not aware of any published series of cases in which so many cases of exophoria treated with prisms have been observed over a period of several years. Dr. Dean's conclusions therefore are original, and are well founded. He has proved that prisms, base in, worn constantly in exophoria, for distance, do not increase such exphoria. The class of cases to which Dr. Dean applies the constant use of prisms also seems to me to be well chosen. In contrast, convergence insufficiency for near is better treated according to my experience by exercises or operation.

DR. F. W. DEAN, Council Bluffs, Iowa (closing discussion): In regard to the cases of ethmoiditis which I reported, they show two things; first, that one is not always sure of a diagnosis; second, that changes in, or in proximity to the orbit, may be the cause of phorias.

Dr. Howe spoke of harnessing the eyes to see which muscle is the weak one. My paper was not on the subject of weak muscles so I have nothing to say in regard to this plan.

## UNUSUAL GLAUCOMA CASES.

WM. THORNWALL DAVIS, M.D.

WASHINGTON, D. C.

Case 1. E. L. A. White; male; 53 years; unmarried; druggist; first observed September, 1915; complaining of aching in eyes and tenderness of the globes.

Family History: Mother was a semiinvalid for thirty years as a result of polyarthritis.

Previous History: Operated twice for varicocele. He has never been robust. Within the past two years he has had three attacks of nausea together with obscuration of vision, lasting about an hour, and passing off without further incident.

Present Condition: The patient now complains that on using the eyes, or when he is fatigued, there is throbbing of the temples and pain in the eyes, together with nausea. On sleeping these symptoms disappear. He is physically a poor specimen and he is intensely neurotic.

Examination of the eyes shows the left disc cupped 1 D. and paler than the right. T.O.D. = 30 mm. Hg.; T.O.S. = 52 (Schiötz). V. = 20/15 and J. I each, with proper correction. Blind spots normal. No scotoma. Physical examination by Doctor Thayer is reported as negative except slight pyorrhea and cardiac enlargement of mild degree.

Treatment: Hygienic and dietary; eserine salicylate gr. 1/20 to  $\frac{1}{5}$ , three times daily and pilocarpine nitrate gr. 1/10 to  $\frac{1}{5}$ , three times daily, alternating.

In March, 1917, the vision was 20/30 and J. I with correction; T.O.D. = 21; T.O.S. = 29. The patient was comfortable. There are fugacious symptoms which may be real or fancied. He was given eserine gr. 1/10 and pilocarpine gr. 1/5 three times daily, alternating.

In January, 1920, the left disc was found to be of increased paleness over the first examination. October, 1920. T.O.D. = 22; T.O.S. = 30; V = 20/15 each. Doctor Barker reports incipient hyperthyroidism, and Doctor Hiram Woods a suspicion of glaucoma simplex.

The eserine was omitted as it blurred his vision. He was given pilocarpine gr. ii to the ounce, three times daily. Fol-

lowing this, the discomfort of his eyes increased, and in November he was put on eserine gr. 1/4 to the ounce, twice daily, in addition to the pilocarpin.

In December, 1920, two small scotomata made their appearance in the left visual field. He complained of seeing black spots before the eyes and of attacks of scintillating scotomata. In February, 1921, no scotomata could be demonstrated; tension and appearance of eyes and fundi were without change.

At the present writing the conditions as outlined remain the same. It is difficult to disengage his neurotic symptoms from those that are real, hence only the objective symptoms are of value.

Is the diagnosis of Glaucoma Simplex justified? It would seem that it is, based on the increased intraocular tension, the presence of the scotomata and the reduction of the visual fields. The intraocular tension, the appearance of the discs, the symptoms and the visual acuity have remained practically unchanged for six years.

Case 2. W. B. White; male; 11 years; school boy; first under observation in January, 1918.

Diagnosis: Glaucoma Simplex.

Family History: Brothers and sisters on examination have normal eyes. They are puny. Mother has chronic asthma.

Previous History: Negative except as follows; for several years he has had attacks of headache and vomiting which were ascribed to dietary indiscretions. For the past three months he has been unable to see clearly at times, and has seen colored rings about lights.

Present Condition: Normal well developed boy; the pupils are large and have a sluggish light reaction; corneae measure 12 mm. each in diameter. The optic discs are cupped 2 mm. each and are pale, the left more so than the right; T.O.D. = 50 mm. Hg. (Schiötz); T.O.S. = 50+. This test was unsatisfactory owing to the child's inability to keep the eyes quiet. V.O.D. = 20/40; V.O.S. = hand movements.

Physical examination shows only infected tonsils and several bad teeth; laboratory examinations negative.

Treatment: Tonsillectomy; removal of infected teeth; diet and habits regulated; eserine salicylate gr. 1/16; pilocarpine nitrate gr. 1/8 to the ounce, three times daily, alternating.

Progress: February 14; V.O.D. = 20/20; V.O.S. = 20/70; T = 55 each; pupils remain large; eserine and pilocarpine in-

creased to gr. 1/8 and gr. 1/4, respectively, three times daily.

March 8. Lagrange operation, left eye, under general anesthesia. March 20: Eye white.  $V = 10/200$ ; put on eserine gr. 1/4, and pilocarpin gr. ss to the ounce, three times daily, alternating.

One year later, the condition of the right eye remained the same. The left (the operated eye) showed a tension of 18, and vision of 20/70. The fields are before you. He is now getting eserine gr. iiss and pilocarpin gr. vi for the right eye only. The left eye is beginning to diverge.

Two years later: T.O.D. = 52; T.O.S. = 18;  $V = 20/15$  and 20/70, right and left eye respectively. He is now on eserine 2% and pilocarpin 4%. Left eye widely divergent. There is a filtering cicatrix of the left eye.

October 1, 1921: Condition of eyes approximately unchanged. The discs are cupping more and becoming decidedly paler. There have been no subjective symptoms since he came under observation; T.O.D. = 53; T.O.S. = 18.

Case 3. F. M. White; female; 52 years; married; first under observation June 21, 1919.

Diagnosis: Right eye, status glaucomatosus; left eye, glaucoma simplex.

There is nothing of interest in the family history or previous history in so far as her general health or condition is concerned. Ten or twelve years ago she noticed failing vision in the right eye. There have been no other symptoms. The eye is now quite blind. The left eye began to fail four years ago, and in the summer of 1918, the vision was very bad. She notices a halo about lights occasionally; this will be brought about by excitement. Following such attacks her vision is poor.

Present Condition: The right eye on examination shows ectasiae about the anterior ciliary veins, ribbon opacity and stippling of the cornea; hypermature cataract and obliterated anterior chamber; blind;  $T = 95$  mm. Hg. (Schiötz); no subjective symptoms.

Left eye:  $V = 20/70$  with correction, which is moderate hypermetropia with astigmatism. There is slight passive congestion of the anterior ciliary vessels. Cornea normal except for a wide thin nebula. Anterior chamber shallow. Pupil round, 3 mm. in width, and gives a sluggish reaction to light. Media clear except as noted. The disc shows a cupping of 5 D. It is uncertain whether the cup involves the whole disc.

There is a slight glaucomatous halo. The retinal vessels are normal. The corneal microscope shows only the scarring of the cornea, the cause of which condition is not to be ascertained.  $T = 80$ .

General physical and laboratory findings are all normal except the teeth. These are very bad. Her habits and hygiene of life are quiet and proper.

Treatment: Diet corrected; directed to have the teeth put in order at once; eserine salicylate gr. i to  $\frac{3}{4}$  in each eye, alternating with pilocarpine nitrate, gr. ii, three times daily; massage of the globes twice daily, together with hot fomentations.

The patient was so much disturbed by the knowledge of the seriousness of the condition, that it was necessary to put her in the hospital where she could be put under a more rigid regime for a time. On discharge from the hospital, her vision was 20/15 with correction, and  $T = 27$ . She complained of the drops clouding her vision. The eserine was reduced to gr. ss to  $\frac{3}{4}$ , and the pilocarpine to gr. i.

July 16,  $T = 35$ ; eserine increased to gr. i and pilocarpine 1%. July 28,  $T = 23$ . October 3, 1919,  $T = 27$ . Complains bitterly of the dark and cloudy vision produced by the drops. The eserine was reduced gr. ss to  $\frac{3}{4}$  and pilocarpine continued at 1%. May, 1920,  $T = 35$ . Complains of black spots, halos and spider webs. Eserine gr. i and pilocarpine gr. vi were prescribed. June 4, 1920. On account of the blurring of the vision the eserine was again reduced to gr. ss to  $\frac{3}{4}$  i.

June 15, 1920. Patient complains that the vision is failing.  $T = 48$ ; disc very white. Vision and fields are as usual. The tension was reduced by massage and hot applications, while she was in the office. It has remained between 26 and 32 since then, and the vision and fields hold good.

#### DISCUSSION.

DR. WM. CAMPBELL POSEY, Philadelphia: Dr. Davis's first case was 53 years of age at the time of first observation in 1915. There was no cupping of the right optic nerve and tension equalled 30 Schiötz. The left disc was slightly cupped and tension equalled 52. Dr. Davis employed a solution of eserine 1/20 grain to the ounce, alternating with pilocarpine of similar strength. Two years later vision equalled 20/30; tension in the right eye had dropped from 30 to 21, and in the left eye from 52 to 29. In 1920, the tension was 22 in the right eye and 30 in the left. Vision equalled 20/15. The fields in both eyes were contracted. A year later the scotoma had disappeared. Dr. Davis judged this case to be one of glaucoma simplex on account of the increased tension, contracted

fields and scotoma. The point of interest in this case seems to me to be the reduction of the tension following treatment in spite of the falling off of the fields of vision. I rather think I should have advised operation on the patient's right eye, in spite of his age. After five years' treatment, this case was still using 1/10 grain eserine and 1/5 of pilocarpine. Would not better results have been obtained by stronger solutions of the miotic, though I take for granted that Dr. Davis was able to maintain the pupils at pinpoint contraction with the solutions which he was employing, weak though they were?

The next case was but 11 years of age, with glaucoma cups in each eye. Right tension equalled 50, left 50. Right field of vision much contracted. Vision in that eye equalled 20/200, and hand movements only in the left eye. Eserine 1/16 and 1/8 pilocarpine were employed. A month later vision had risen from 20/40 to 20/20 in the right eye; in the left, from hand movements to 20/70. The dose of the miotic was doubled. A Lagrange operation was performed on the left eye, vision remaining the same in the right. Following the operation, vision in the left eye rose to normal. A year later vision in the right eye was 20/15, but had fallen in the left eye to 20/70, notwithstanding the operation had brought the tension to 18, while it was 52 in the right eye. In October of this year there was a good field of vision in the right eye but the left a temporal field merely.

I have seen a few cases of juvenile glaucoma and prefer to operate, iridectomy being my favorite procedure, as I believe that the degenerative changes are less apt to follow this operation than any other. After operation I have seen both fields and central vision improved. It is most essential that the disease should be recognized in its incipency and operated on early, to obtain the greatest improvement.

In Dr. Davis's Case 3, the right eye was blind from glaucoma and the vision reduced in the left to 20/70, tension being 80. Eserine and pilocarpine were ordered and 3 months later vision rose to 20/15, tension having fallen from 80 to 27. The miotics were weakened. In April, 1921, two years after the patient was first observed, tension was noted between 26 and 32. It demands a far wiser man than I to attempt criticism of the treatment which has been carried out in this class of cases. With miotics vision has been conserved for 2 1/2 years and who would dare assert that operation could have done better, for it is in this very class of cases that operative risk is greatest. My own observation has been that miotics are of especial value in those very desperate cases with limited field of vision, and I have elsewhere reported a group of them where vision has been maintained for a long time by maintaining the pupils at pinpoint contraction.

DR. HIRAM WOODS, Baltimore, Md.: I want to ask a practical question: how far, in the management of chronic glaucoma, should we be guided by the revelations of the tonometer, and how far by visual conditions? In Dr. Davis' case, the tonometer usually showed hypertension, but repeated tests of vision, indicated that no harm was being done.

In another case which I had under observation, the right eye had been destroyed by an accident in boyhood. After the man had passed his sixtieth birthday, he began to suffer some pain in this lost eye. There was no light perception and his tension was over 70. The eye

was not otherwise inflamed. He refused enucleation and iridectomy was done in 1918 to relieve pain. The results were all that could be desired. I thought the cause of pain was a glaucoma, showing itself first in one eye. At that time, the left eye was normal save for its compound myopic astigmatism. Central vision was 20/40. A year later, tension was 70 with the visual condition unchanged. During the past two years, I have been able to keep his tension down to 30 and the eye has been useful.

In view of the well recognized uncertainty of any operative procedure for chronic glaucoma, should I be guided by the tension or the effect of the myotic on vision? My own judgment is that as long as vision does not change, we had better let the eye alone, in spite of the fact that the tonometer shows *slight* hypertension. The difficulty is that there is a great deal about the etiology of chronic glaucoma which we do not know. Eye tissues do not always tolerate operation. At the last meeting of the American Ophthalmological Society, I reported under the title of "Friability of the Iris," three cases of attempted iridectomy in chronic glaucoma. It was impossible to complete the operation in either case, and the results were very doleful.

DR. C. W. HAWLEY, Chicago: The heading of the paper is "Interesting Cases of Glaucoma." So far as I can see, the histories are only those we have all met with in the past. From the experience of the past four or five years, I believe we are working at the wrong end of the problem entirely. We should hang more on the cause of our glaucomas, and not merely the treatment of the end. None of the men to-day have, so far as I can judge, looked for the cause of the glaucoma in their cases. Four years ago, before the Pacific Ophthalmologic Society, I read a paper on six cases of glaucoma cured up to this time, with the exception of one case. I did not depend on eserine and pilocarpin. I went after their autointoxication and all six got well; that is, no condition worse than that seen four years ago. The main treatment was given to the curing of the autointoxication. I repeated that this year. I wish I had more time to give you the history of this case. One significant thing is that five were one eyed people. So you see where my responsibility lay. Only in one case have I had to do an iridectomy. It was a case of simple glaucoma. This one woman in January had a terrific attack of flu, and I feared to let it go further to save the one eye she had, so did an iridectomy. I had removed the other eye twenty-two years ago. I intended to have brought a more extended history of this case, but neglected to do so through carelessness. But I hope you will take up your cases and see if you can find some cause, rather than treat the glaucomas only. One case was cured by the removal of badly decayed teeth. About a month ago she told me this had been successful so far. Investigate your cases.

DR. W. T. DAVIS, Washington, D. C. (closing discussion): Dr. Posey thinks the miotics might have been used in stronger solution in case one. I used them as strong as the patient could stand them and still pursue his avocation. They could not have been used stronger without very greatly interfering with the patient's vision. This is usually my guide to the strength of the miotics used; that is, I use a solution which will contract the pupil ad maximum without too greatly blurring the vision.

Dr. Woods suggested that the tonometric reading is not to be taken as a guide for operation. It is evident I have not followed these readings in this regard, but the general *ensemble* of the case, whether the visual fields were holding good, or other changes occurring that might have a bearing on the progress of the case.

Dr. Hawley spoke of looking for the cause. All of these cases have been most carefully studied by competent internists and myself, and every possible known cause has been removed; but who can say what is the cause of posterior glaucoma?

## THE USE OF THE GULLSTRAND SLIT LAMP.

HARRY S. GRADLE, M.D.

CHICAGO.

The value of the slit lamp depends upon one of the simplest principles known to physics, so simple that it was overlooked until Gullstrand adapted it in the instrument that has added so much to our knowledge of the human eye. The principle is that of simultaneous contrast. A particle of dust floating in the air of a diffusely illuminated room cannot be perceived because of the lack of contrast. But allow a beam of sunshine, or any concentrated light of sufficient intensity, to pass through the room and the particle of dust becomes visible immediately and clearly, due to simultaneous contrast. The same principle holds true in examination of the tissues of the living eye with varying degrees of magnification. A diffuse illumination does not allow the particle of tissue in ques-

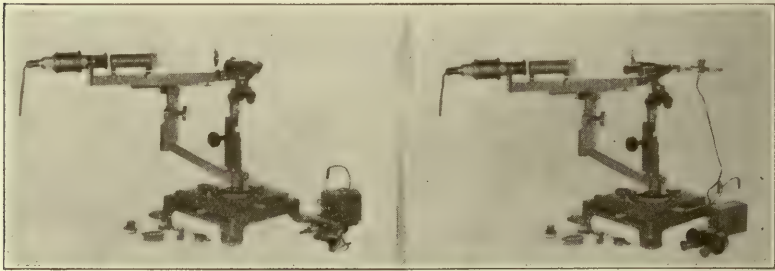


Fig. 1. Photographs of Gullstrand slit lamp and accessories.

tion to stand out in contrast to neighboring particles. But the concentration of a beam of intensive light upon an area, at the cost of illumination of adjacent areas, reveals details of structure hitherto unknown. Such is the power of focal illumination and simultaneous contrast.

Microscopy of the living eye is accomplished by means of a combination: a microscope, and a focal illuminant.

The binocular microscope is not of recent origin, although many improvements have been added to increase the efficiency. In 1899, Czapski developed the microscope that to-day bears his name. It consists of two convergent tubes with a double objective, and two oculars. The rays of light from a point

pass through the converging objectives and fall upon a pair of Porro prisms, which reverse the image and bring it into an upright position and at the same time allow the tubes to be swung apart or together, to coincide with interpupillary distance of the observer.

The rays are then continued through the well known Huygens oculars, which collect the main rays diverging from the objectives, which enlarge the image received from the objectives and bring the rays to a parallel or converging course, in order that they may be properly focussed upon the retina of the observer. By changing the objectives as well as the oculars, magnifications ranging from twenty to one hundred and three diameters can be obtained.

For examination of the deeper recesses of the eye, a modification of the corneal microscope, known as the "Bitumi,"

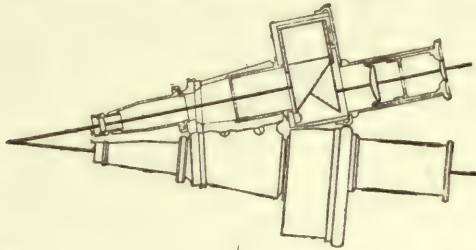


Fig. 2. Schematic cross section of binocular corneal microscope.

has been devised. This consists of a single objective of somewhat greater length, a single microscope tube, a set of half-silvered glass plates, which function essentially the same as the glass prisms in the Abbe stereoscopic ocular, and a pair of parallel oculars. The interpupillary distance of the observer is accounted for by a simple device, which separates the parallel ocular tubes the required distance.

The Bitumi presents the following advantages over the binocular corneal microscope: (1) greater magnification, even beyond the limits imposed by the involuntary movements of the eye under observation, and (2) penetration into the deeper structures, that are without the pale of the Czapski, because of the separation of the entrance pupils of the converging tubes. On the other hand, the Bitumi is somewhat more difficult to handle (the image is reversed) and there is a considerable loss of light.

The illuminant is a 25 volt Nitral lamp, operating upon a 110 volt current with an interposed resistance. The lamp

itself has a tightly wound spiral filament within a rather small gas filled chamber, and presents as nearly as possible a vertical line of light. The divergent rays are rendered parallel by a single planoconvex lens, and are again converged by a planoconvex lens upon a slit of variable dimensions. The spherical aberration is to a great extent eliminated by having the spherical surfaces of the lenses facing each other. Thus an image of the luminous filament is formed in the slit.

The almost parallel rays of this image are then brought to a linear point by the condensing lens at the end of the lamp arm. Lateral diffusion is eliminated by the tube interposed between the slit and the condensing lens, which tube also serves to carry various filters that are used in special examinations. For penetration into the deeper structures of the

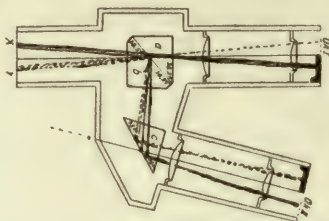


Fig. 3. Schematic course of rays through Abbe stereoscopic ocular.

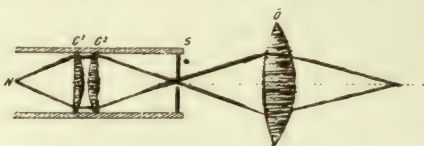


Fig. 4. Schematic course of rays in the illuminating apparatus.

eye, a metallic mirror is set in an upright at the extreme end of the lamp arm, beyond the condensing lens. When it is necessary to make the angle of convergence of the axis of illumination and the axis of observation as small as possible, the lamp arm is put at right angles to the axis of observation, and the illuminating beam is turned at right angles by the mirror. This eliminates mechanical difficulties.

Exact centration of the lamp is essential. The lamp socket must be rotated until the filament is exactly vertical and then locked in place by the fixation screw. The slit must also be vertical and so placed that the image of the slit falls in the exact center of the condensing lens. Lateral movement of the slit is provided for by a helical arrangement. In the beginning, it is preferable to open the slit as wide as possible, but

for varying conditions the width may be reduced to advantage.

The patient must be seated comfortably with the chin resting firmly upon the chin rest, and the head braced against the forehead rest. Strained and unnatural positions should be avoided. The patient should be instructed where to look and in many cases, the small fixation lamp attached to the instrument is of great value, particularly in examination of the fundus. To obtain the first rough position of the microscope, the eye may be sufficiently illuminated by withdrawing the lamp until the broadened slit covers a fair share of the cornea. The microscope should then be moved by means of the double adjustable base until the primary rough focus is obtained. The lamp is then moved forward until the image of the slit appears upon the cornea, in approximately the focal size. The final, fine adjustment is made with the rack and pinion that operates the condensing lens upon the lamp arm. The observer, who by this time has adjusted the microscope to his own interpupillary distance, focuses the microscope upon the tissue under examination. If the left eye of the patient is being observed, the lamp is upon the observer's right, and his right hand is occupied with the rack and pinion adjustment of the condensing lens and with the lateral motion of the base, while his left hand manipulates the fine adjustment of the microscope and keeps it trained upon the area in question. The reverse position obtains for the other eye.

Four types of illumination come into consideration. The first is the basic principle of the instrument, *direct focal illumination*, and has already been discussed. The second is illumination by *indirect focal light*. During the observation of any specific area by direct focal illumination, it will be noticed that contiguous areas can be seen and in a more plastic form, owing to their illumination by reflected and diffused light from the more brightly illuminated zone. This method is particularly of value for the study of delicate opacities. The third is *dark field illumination*, and applies of course only to the transparent or translucent areas of the eye. The focal point of light is directed upon an area behind the structure to be observed, which then stands out in the well known dark field form. The examination of structures with different indices of refraction, as blood vessels or nerves in the cornea, is facilitated by this method. The fourth, and but little used type, is observation in an *oscillating light field*, where the oscillations are produced by manipulation of the lamp arm.

For examination of the background of the living eye, a slightly different technic is employed. The lamp arm is placed at right angles to the axis of the Bitumi, and the beam of light is bent at slightly more than ninety degrees by the metallic mirror at the end of the lamp arm. The illuminating bundle thus forms a sharply convergent bundle, with the axis of observation and the mirror in juxtaposition with the tip of the microscopic objective.

In order to bring the image of the background forward to within the range of the microscope, it is necessary to use a contact glass of the type designed by Fick. Such a glass fits directly over the cornea, and has a posterior radius of curvature of 8 mm., and a diameter of 12 mm. The anterior surface of the glass is ground flatter than the posterior, has a radius of 10 mm. and an equivalent value of  $+5$  D. This makes the refraction of the glass equal to  $-59.5$  D., and brings the image of the retina some 16.7 mm. behind the posterior surface of the

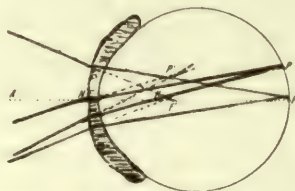


Fig. 5. Schematic course of rays through contact glass, showing how the retina is brought forward.

cornea, or about in the middle of the anterior third of the vitreous. This image is slightly smaller than the true retina (0.96).

For such observation, it is necessary to have the eye in good mydriasis and well anesthetized. The patient's head should be tilted forward, and the lids opened with the fingers of one hand. The contact glass, previously filled with warm normal salt solution, is then applied directly over the cornea, which must be tilted slightly downward. Immediately upon application of the glass, the patient must look directly forward and the lids allowed to close spontaneously. (It is almost unnecessary to add that fingers must not touch the observation surface of the glass, because of resultant diffusion by adherent grease.) If a bubble lies between the glass and the cornea, the procedure must be repeated, or else the upper edge of the glass can be lifted away from the sclera with an iris spatula, and a thin stream of salt solution allowed to fill

in from a small pipette. The flattened portion of the glass should be directly over the pupillary area of the cornea, and should there be a tendency to drop, the glass can be held in place by light pressure on the lower lid. Removal of the glass is accomplished by lifting the upper edge with the spatula, whereupon the upper lid in closing forces the glass out. Care must be taken to avoid dropping or scratching the glass.

After the contact glass has been applied, the patient is seated before the Bitumi as previously described, and the lamp arm and metallic mirror adjusted so that the focal slit falls first upon the edge of the iris, and then 14 or more mm. behind it. The fine adjustment must be made with the entire apparatus rather than with the condensing lens. The Bitumi is then moved into place, and the brilliantly illuminated fundus comes into view. The same adjustment holds for the

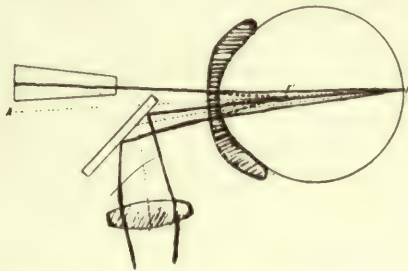


Fig. 6. Schematic course of rays in microscopy of the human fundus.

examination of the vitreous, merely changing the focus of the different instruments.

The angle of the anterior chamber may be examined in the same manner, although the use of a miotic is necessary, and the patient's head must be turned about 45 degrees on the chin rest. A different type of contact glass is used, with a concave anterior surface ground upon a heavily convexed surface. The illumination enters through a very sharp angle, while the observation axis is nearly parallel to the surface of the iris. Needless to add, it is much simpler to examine the chamber angle from the temporal than from the nasal aspect.

From the foregoing rough description, it can be seen that many new phases of examination of the living eye are made possible by the use of the slit lamp of Gullstrand. For daily clinical use, the binocular microscope and the first three types of illumination mentioned afford a much more intimate knowl-

edge of pathologic processes of the anterior eye than was ever deemed possible, and practice renders such examinations fairly rapid. The use of higher magnifications, and of the apparatus for examination of the chamber angle and of the background, is somewhat more laborious, but in many obscure cases the

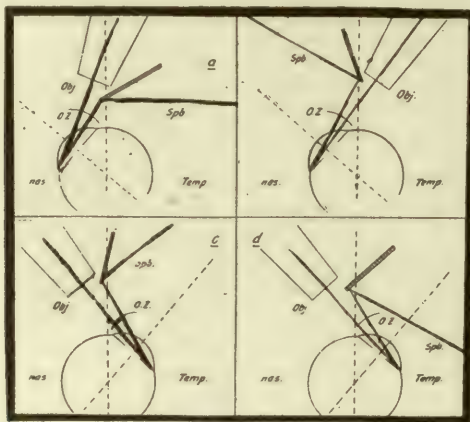


Fig. 7. Schematic course of rays for chamber angle microscopy.

time thus spent is well recompensed by the more intimate knowledge gained.

Many of the schematic illustrations used are taken from Koeppe, "Die biophysikalischen Untersuchungsmethoden der normalen und pathologischen Histologie des lebenden Auges."

#### DISCUSSION.

DR. A. J. BEDELL, Albany, N. Y.: The instrument, as detailed by Dr. Gradle, has placed at our immediate disposal a means of study and of diagnosis that will rival the ophthalmoscope in importance of application.

Under the instruction of Dr. Edmond E. Blaauw, of Buffalo, many of the conditions outlined by Vogt and Koeppe have been seen, and although the German literature has many references to the normal and pathologic pictures, I wish at this time to emphasize the importance of an examination in corneal, iris, lens and deeper lesions.

It is essential for the proper use of the instrument that examination be made in a black room, and that time be taken to adjust patient and examiner to the reduced illumination. For some cases dilatation of pupil is essential, but for others the unchanged iris gives more valuable information.

The easiest thing to see is the actual blood stream as it is irregularly propelled within the conjunctival vessels. That the study of these blood vessels may be of value time will tell, but certainly it will be at least interesting to make such observations. In the cornea, the nerves

are followed in their course, and the epithelium, true stroma and the endothelium show as well as on microscopic section. This last has been well illustrated, and we have seen it beautifully. Deposits on Descemet's membrane of varying types, the interpretation of which must engage our attention for years, appear sharply in the illuminated area.

Those of you who have used the corneal microscope have noted the numerous elevations and depressions on the iris, the variations of pigment and the unnumbered pupillary margin alterations. This better illumination gives much more detail and makes it possible to detect changes hitherto invisible. Because it is possible to trace the blood vessels, there should be no more uncertainty as to whether a given flushing of the globe is the simple injection of conjunctivitis or the early stage of an iritis, interstitial keratitis or some other serious change. This one thing is important enough to warrant the use of the instrument. Finally, the innumerable lens changes so easily seen, may offer an explanation of the formation of cataracts, perhaps even suggest a method of hastening opacity, checking its development, or even absorbing it.

To summarize, the instrument is of inestimable value in the study of anatomic and pathologic changes.

Time must be taken to understand the normal and to adjust to each individual examination. Many diseases may be diagnosed earlier and many others more certainly with it. A realm of therapy is to open by the concentration of the light on the site of the lesion, as in tuberculosis of the iris.

DR. F. PARK LEWIS, Buffalo, N. Y.: There is no question whatever as to the scientific value of the Gullstrand lamp. What we are all anxious to have determined is how practical it is in our daily work. As a corneal microscope its use has been demonstrated for years. The added value is in the slit lamp which Gullstrand has given us, and which enables us to see amplified images of the deeper tissues which were never before visible. The instrument is expensive and it occupies considerable space, both of which are important considerations for many of us. I am sorry Dr. Blaauw is not here, because he was one of the first, if not the first, to import the Zeiss instrument, and through his courtesy, we in Buffalo have had an opportunity of becoming fairly familiar with its possibilities. To see the corneal structure with it is not difficult. It is also easy to see the iris, the capsule of the lens and some of the deeper structures of the lens. This alone makes it of great value. In studying the deep tissues of the eye, very much time and technical skill are required, but that will come from use. In Paris during the past summer, I found a few of the instruments in the clinics. Dr. Lucci, Vogt's first assistant, had been there instructing the ophthalmic surgeons in its use. Koby, the former first assistant of Vogt's, had written a brochure adding valuable information to our knowledge of its findings. The place, however, where it has been developed to the greatest extent and in the hands of its master, is in the clinic at Basle. There I had the pleasure of seeing the proof sheets of the atlas which Prof. Vogt is soon to publish, and the possibilities of the instrument there developed would seem to be almost beyond belief. Details are wrought out of whose very existence we have not known. There is no doubt, that much can be

easily learned that is of practical value from the use of the corneal microscope in the hands of one ordinarily expert. There is much that may be learned that will take months of practice, and that can only be determined by a skilled expert, and one who is willing to give time and patience to its study. It is interesting to see the spots in the descemetitis resolved into galaxies of stellate deposits; to see the depth of the cornea and to study the epithelium. The probabilities are that we shall be able to determine in this way, by the appearance of the iris, beginning degenerative changes which are later to appear in the lens. It is an instrument which will be found ultimately in the office of every progressive ophthalmologist. In the meantime, there should be a public clinic equipped with the Gullstrand instrument, to which those who are unable to own one, by reason of its cost or lack of room, may at least be able to take their cases for the complete examination which should be made.

PROF. VAN DER HOEVE, Leiden, Holland: With regard to the difficulty Dr. Lewis and Dr. Blaauw had, at the beginning, with the large lamp, it was impossible to use the instrument in the right way, because one could not get as near to the patient as was necessary for the illumination for the corneal microscope. When you came as near as was necessary, you were unable to see anything. That is the reason the instrument is used by so few clinics. Now we have the small lamps, we can use them better. It is not necessary to stay long in the dark room before we can use it. I believe this instrument will be used in the future.

DR. F. H. HESSLER, Philadelphia, Pa.: You will get a fair interpretation of this instrument in studying tissues. It depends on how precise and exact a knowledge one has of the pathologic anatomy. It cannot be interpreted by the study of pathologic anatomy in books.

DR. CHAS. WALKER, Denver: For fifteen years I have been using a Zeiss corneal microscope. The corneal microscope is the same as this, only it has a lamp that throws a light, and you can see magnified as far as the anterior portion of the vitreous. It is a most valuable instrument, in my experience, and much less expensive than this, and I believe that by some contrivance you can get as far as the fundus. I think it is a great addition to have this extra light, and can see no reason why this could not be attached as an extra light, as the lamp could be removed, and the extra light brought in the direction that Dr. Gradle has been telling us about. It is one of the best things I have ever had in my office.

DR. JOHN A. SPENGLER, Geneva, N. Y.: I would like to ask the Doctor for information as to the value of polarized light in diagnosis of incipient cases of cataract? Certainly the light passing through would be polarized. Also, has there been a study made regarding this question, giving particulars?

DR. HARRY S. GRADLE, Chicago (closing discussion): Dr. Walker spoke of the possibility of an extra lamp. This is now being constructed by an American manufacturer and will be put on the market shortly.

With regard to the lens, I refer the doctor to Koeppé's second book, in which he takes up the study of polarized light. This will answer the question in detail.

## OCULAR GROWTHS OF A NEVOID CHARACTER.

H. D. LAMB, M.D.,

SAINT LOUIS, MISSOURI.

The ocular nevus should have an interest for the general ophthalmologist and not alone for the eye pathologist. As one of the former, then, I propose to briefly describe a few nevi that have come to my notice, (all from the practice of others), attempting at the same time to give a clear and concise picture of this important ocular growth.

The neoplasm known as the true nevus is a benign one, typically composed of the so-called nevus cells as its essential constituent. The term nevus (from the same word in Latin meaning a blemish) is commonly used to designate any flat or slightly raised neoplasm in the skin or a mucous membrane, characterized by a distinctive coloring which marks it off from the surroundings. This name of nevus is therefore rather loosely applied to many forms of surface hemangiomas and lymphangiomata, which practically always possess a color contrasting with those adjacent. The true nevus occurs much more commonly as pigmented, but even when not, has a yellow-pink or yellow-red coloring in life. Pathologists as MacCallum<sup>1</sup> and Kaufmann<sup>2</sup> often call the true nevus by the name of nevus pigmentosus. There is at present much confusion as to the structure of growths designated simply as nevi, warts or moles. However, in the case of the term nevus, there is a fairly accurate picture conveyed if we could call by that name only those neoplasms consisting mostly of nevus cells.

These nevus cells are not usually difficult to differentiate from others, for they are as a rule large, round or oval cells, but sometimes angular (when crowded together) with a small amount of cytoplasm surrounding large, round, oval or angular nuclei, which latter stain darkly.

The nevus has been and is still the subject of much study and controversy as to the origin of its essential cells, whether from the epidermis, from chromatophores or from other derivatives of the mesoderm.

The role of the pigment granules is an important point in these discussions, particularly since the presence of the

pigmented nevus in the skin and mucous membranes is connected with the origin of the melanoma, which is any neoplasm composed of cells containing the pigment melanin. It will be recalled that the small amount of pigmentation sometimes found in the conjunctiva, at or near the limbus of the Caucasian, is due to pigment granules lying mainly in the basal epithelial layers. Chromatophores in the subepithelial tissue play only a small part. Wolfrum<sup>3</sup> has confirmed this view and added that the basal cells of the epithelium between the connective tissue papillae are chiefly provided with pigment granules, while in the thinner portion of the epithelium, on top of the papillae, the basal epithelial cells may be entirely free from pigment. In this connection, Birch-Hirschfeld<sup>4</sup>, in a recent publication, states that there may occur in both benign and malignant growths, particularly vascular ones, rather characteristic round or oval cells containing blood pigment. These pigment cells may be arranged in circular groups or in strings; the presence of such blood pigment cells alone would make it wrong to speak of the growth containing them as a melanoma, pigmented nevus or melanosarcoma. He advises sectioning of the entire excised piece of tissue.

As Ribbert<sup>5</sup> says, one goes first to the eye for the best study of the melanoma or pigmented nevus, since in the conjunctiva its structure is simplest, and histologic sections from there can be obtained very thin.

Let us now turn to a study of our cases and sections, which I hope will make at least fairly clear some different forms of the nevus as it occurs in the eye.

The specimens in all these cases were fixed in formol, imbedded in paraffin and stained with hematoxylin and eosin.

The first from the practice of Dr. F. E. Woodruff, is a girl of twelve years old, whose father gave a history of there having been a black speck on the white of the left eye for at least several years (he did not know how long). Dr. Woodruff found at the temporal limbus, in the horizontal meridian, a black fleck about one-half millimeter in diameter, lying rather deeply. The conjunctiva anterior and external to this fleck, although remaining transparent and colorless, was slightly and smoothly elevated over an area of about three millimeters by one and one-half millimeters. Excision of the black spot and a goodly portion of the surrounding conjunctiva was made, the black spot encroaching onto the cornea so as to

make its corneal side rather difficult to remove. The remainder of the growth came away freely.

**MICROSCOPIC FINDINGS:** The thin, flat bit of tissue, rather wrinkled, consists for the most part of the usual conjunctival and episcleral connective tissue, covered by the normal stratified epithelium. At one spot in the superficial layers of the latter are several goblet cells.

At the corneal end of the specimen is the principal accumulation of nevus cells. These cells occur thickly in a rather

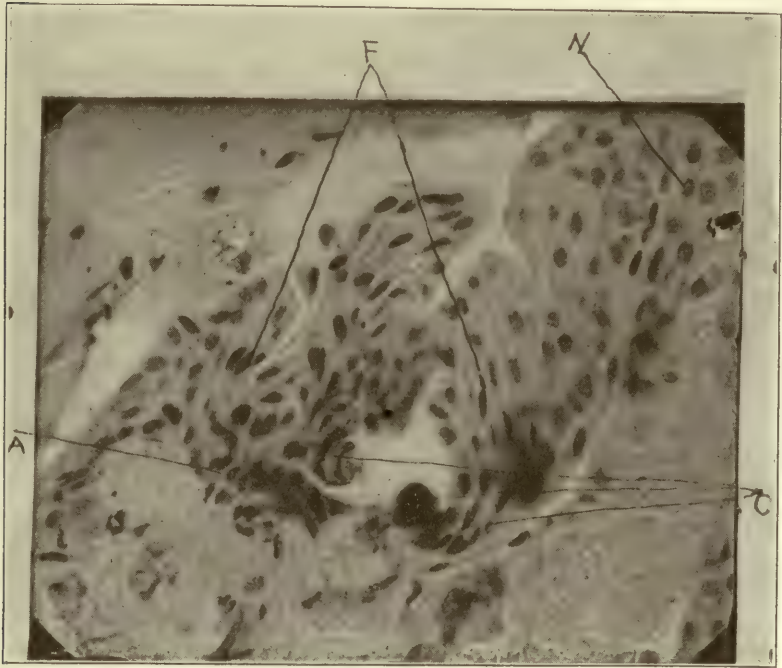


Fig. 1. Strip of surface epithelium, in which epithelial cells are undergoing changes. N—Normal surface epithelium; F—Flattened epithelial cells; A—Nevus cells; C—Cytoplasmic masses containing much nuclear material.

uniform manner, and only on the side away from the cornea are they arranged more loosely and in irregular alveolar groups.

Between the cells, lies a connective tissue network, which is rather delicate in structure but easily made out.

At the corneal end of this mass, is present a group of a comparatively few nevus cells, densely packed with light brown pigment granules. Surrounding this group, there are

many other nevus cells, containing a small amount of fine pigment granules of the same color. Also in the intercellular connective tissue, here and there, are not a few fine granules of pigment.

Some of the sections show extension of this nevus cell mass outward to almost two-thirds of the width of the piece of tissue excised. As it is impossible to tell accurately the limits of such a growth, free excision is indicated.

The epithelium overlying the mass of nevus cells is distinctly thinner than it is in the remainder of the specimen; a thin layer of connective tissue separates completely the epithelium from a tumor mass except at one spot. At this place, the main mass of essential cells is rather brokenly connected with an inclusion of nevus cells, lying isolated in a distinct group within the surface epithelium. Several other similar inclusions are present in this specimen. These groups are rather typical examples of such epithelial inclusions which Unna<sup>6</sup>, Della Favera<sup>7</sup> and Wolfrum<sup>3</sup> have considered to strongly support the theory of the epithelial origin of the nevus cell. Ribbert<sup>5</sup> however claims they are derived from chromatophores, which have immigrated from the subepithelium and multiplied.

At another place in the epithelium, entirely distinct and some distances away from the main nevus cell accumulation, there is a place where two small circumscribed groups of nevus cells occur lying in touch with, and just beneath the basal epithelial layers. The epithelial cells in several of these lower layers, just above and in contact with these nevus cell groups, differ from the surrounding epithelial cells in having less cytoplasm and darker staining nuclei.

Still further along in the same section, there is found a long thin line of nevus cells, arranged fairly loosely and lying just beneath the epithelium, but separated completely from it by a thin layer of connective tissue.

Between these last two places there occurs the only down-growth of surface epithelium observed in any of the sections of this specimen.

At still a third place (Fig. 1), in a small strip of isolated surface epithelium, there can be noted definite changes in the cells throughout almost its entire thickness. The cells are here generally more loosely arranged, well marked spaces between them being made out under high power. Several layers

of epithelial cells, having become much flattened and curved, form a three sided ring, at the middle of which changes to the enclosed epithelial cells of the basal layers are occurring. The usual arrangement of the epithelial cells is here much broken up; several groups occur of from seven to ten cells rather closely united. The cells of individual groups are roughly similar in size and shape, but those from different groups vary greatly; the shapes are generally oval, flattened or sickle-shaped. The cytoplasm belonging to these central cells stains

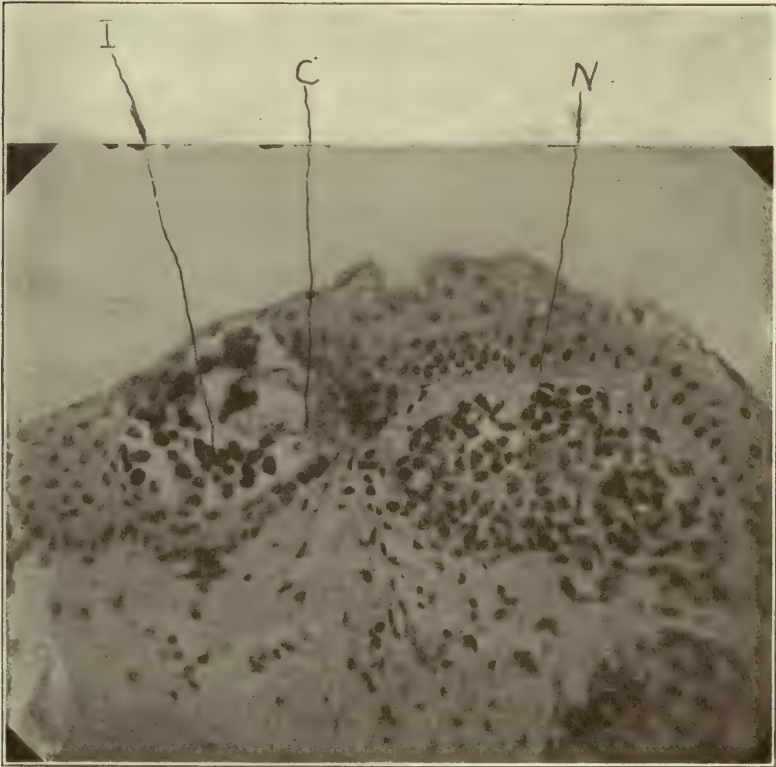


Fig. 2. Inclusion of nevus cells within the surface epithelium containing connective tissue. I, nevus cell inclusion; C, connective tissue bands; N, nevus cell group beneath epithelium.

quite a little darker and bluer than that of the neighboring unchanged epithelium; it is also present in much less quantity in proportion to the size of the nuclei. All the nuclei here stain uniformly quite darkly and densely. At quite the center there is much nuclear staining material; in fact at several places there appears to be many rather small, dark nuclei

imbedded in a comparatively small amount of dark cytoplasm. One of these masses contains, at one side, all the nuclear material, which is arranged in layers of very thin, flat and sickle-shaped pieces. At the other side of this cellular mass there occurs a small amount of pigment, consisting of a little group of light brown granules. At no other place could pigment be made out in or among these cells. Cells lying isolated near the center resemble nevus cells in their characteristics much more than they do epithelial cells. We conclude that nevus cells are here in the process of formation. This appearance is similar in its essentials to those described by Unna<sup>6</sup>, Fava<sup>7</sup>, Wolfrum<sup>8</sup> and others for the origin of nevus cells.

The intercellular connective tissue between the nevus cells is present as a fine net work in those groups lying beneath, and out of contact with the epithelium. Those cells in contact with the epithelium, however, apparently contain no intercellular substance, as such nevus cells are probably newly formed. In one of the nevus cell inclusions of the surface epithelium (Fig. 2), there are bands of connective tissue, extending from the surrounding epithelial cell wall at one point. These stain a little darker than the nearby subepithelial connective tissue, and apparently come out from between some basal epithelial cells adjacent to the inclusion area. These particular basal epithelial cells differ little from those in a similar situation elsewhere, except the nuclei are smaller and stain more darkly; the cytoplasm is comparatively much less in quantity. Amongst these connective tissue bands, are noted several moderately large oval nuclei, which stain very faintly. Their appearance resembles mostly that of fibroblasts.

Kromayer<sup>8</sup>, Judalewitsch<sup>9</sup> and Birch-Hirschfeld<sup>4</sup> report being able to establish the formation of intercellular connective tissue fibers from basal epithelial cells or from nevus cells. This is analogous to the origin, according to Salzmann<sup>10</sup>, of the muscle fibers of the sphincter pupillae and the dilatator pupillae muscles from pigmented epithelium on the posterior part of the iris. Ribbert<sup>5</sup> contends that the nevus cells to be able to form the intercellular network of fibers, must be mesoblastic in origin.

Pigment, except as has been already mentioned, was present in very small amount, scattered here and there in the subepithelial connective tissue, near the main cell mass: also a very few free nevus cells, moderately filled with pigment granules, were found in the same place.

Although our specimen might be called a pigmented growth, yet the absence of pigment in all the nevus cell inclusions and basal epithelial cells (except at one spot in very small amount) seems significant. Pigment does not seem to play a very important role in this case.

The second case, a patient of Dr. John Green, was that of a boy of thirteen years, who had a small, elevated, slightly pigmented growth on the caruncle of the left eye. The growth

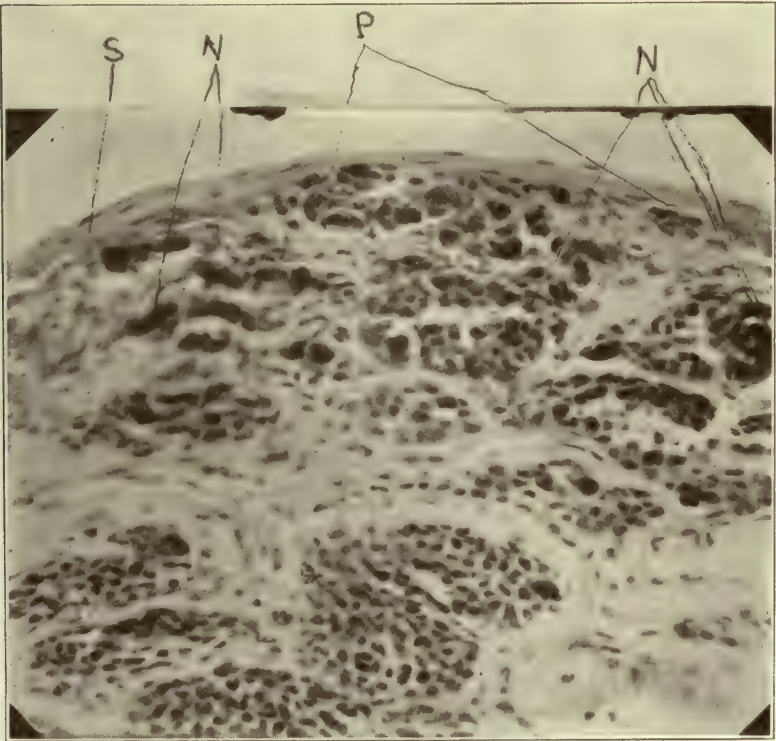


Fig. 3. Pigmented nevus cell groups near surface epithelium. S, surface epithelium; P, pigmented nevus cells in close association with epithelium; N, large cells with two or more nuclei.

was removed with scissors and the base cauterized with pure carbolic acid.

**Microscopic Findings:** The entire growth is seen to be composed almost entirely of comparatively small nevus cells, in the midst of which are several hair follicles with their sebaceous glands. Even thin sections appear fairly compact, although there are many clear spaces.

On the side of excision, there is a connective tissue base; in some sections it appears as a pedicle. Fibrous tissue extensions proceed from this base to all parts of the growth, forming connective tissue rings, within which lie the nevus cells. This alveolar arrangement of the nevus cells prevails over a large part of the growth; in many places the fibrous tissue envelope is quite thick. Between individual nevus cells, a very fine fiber network is sometimes present; in many places, however, no intercellular substance can be made out.

The clear spaces in the sections for the most part are simply very irregular areas free of all tissue, with no wall of their own; appearing as if their former contents had dropped out. One large open space and several small ones are evidently cystic, as their contents are seen to be serous with a few nevus cells; their wall is fairly regular and composed of nevus cells. Many of these cells in the wall of the cysts show marked mucous degeneration, resulting in much swollen, clear cell bodies which force the nuclei to one side. The cytoplasm of the inner layer of these nevus cells increases and joins together to make an inner surface lining to the cyst. Sometimes, as in the case of the largest space, there are places where this inner surface is very smooth. Two or three layers of nevus cells form the cyst wall, surrounding which there is a narrow ring of connective tissue. Another large cystic space, containing a little detritus with a number of nevus cells, is lined with a single layer of cuboidal epithelium. The nuclei of this epithelium greatly resembles those of nearby nevus cells in their appearance. Outside this epithelium, there is seen a well marked connective tissue basement membrane.

The surface epithelium is quite thin, consisting of but three or four layers of epithelial cells, mostly flat. From it extend a few epithelial downgrowths, most of which are small.

Pigmented nevus cells occur only near the surface, at the most prominent part of the growth. Here (Fig. 3), the nevus cells are arranged in small, rather flat, oval groups or islands, surrounded by exceptionally thick rings of connective tissue. The pigment here is almost all intracellular, and is of a dark brown color, appearing mostly in fine granules. There are in this region many large pigmented cytoplasmic cells, containing two to eight large darkly staining nuclei. It is evidently an active area of proliferation. Here and there, pigment is found over short distances in the basal epithelial layers.

The nevus cells in many places lie in direct contact with the covering epithelium and its downgrowths; many times it is impossible to distinguish between them. It is hard to believe but that in many spots epithelial cells are being changed to nevus ones. Quite a few nevus cell inclusions are met with both in the surface epithelium, and in the epithelial covering of the hairs.

Blood vessels occur in greater amount in the pigmented portion of the specimen.

Saemisch<sup>11</sup> tells us that when the nevus progresses, it is only the pigmented one that becomes malignant.

Unna states in his work on the biochemistry of the skin, that all the authors on this subject are of the opinion that the pigment is indigenous in the cells; the majority think the source of the melanin is alone or chiefly in the epithelial cells. More accurately lies its source, according to Meirowsky<sup>12</sup> and Dyson<sup>13</sup>, in the nucleus of the epithelial cell.

The third case, from the practice of Dr. J. W. Charles, was a girl of eighteen years, whose left eye showed a cystic growth at the temporal limbus. The history given was that it had been present since a very young child, but that in the last few years previous to consulting Dr. Charles it had noticeably increased in size. Free excision was done.

**MICROSCOPIC FINDINGS:** The sections from this tissue (Fig. 4), showed a thick connective tissue base, on which lay a rather thin flat surface layer of neoplastic tissue. The latter was found to consist mostly of nevus cells, in which occurred enormous cystic areas. In some sections, almost the entire area of the tissue consisted of empty cystic spaces. However, in many places, the nevus cells were densely massed together.

Connective tissue extended up from the base of the growth, forming an intercellular network between the nevus cells, basement membranes to the cystic areas, fibrous rings about groups of nevus cells, fibrous rings about groups of epithelial cells, and a thin connective tissue sheet between the main nevus cell mass and the thin surface epithelium.

Epithelial cell groups are noted in some sections where cysts do not show so prominently. The cells in these islands are all polygonal except that of the outer or basal layer, which is composed of cuboidal epithelial cells similar to those of the basal layer of the surface epithelium. Several of these epithelial cell groups show small cystic cavities at their centers.

The large cystic spaces occur where the nevus cells are thickest; their walls are thin and composed in general of two layers of cells. These wall cells are probably nevus in most cases; the outer layer, next to the connective tissue basement membrane, is a thin fairly regular line of cells. The inner layer of cells is characterized by a large increase of cytoplasm and a smaller increase in the size of the nucleus, which stains lighter. The cytoplasm of adjoining cells, in this layer, joins together to form in many places a smooth inner lining to the

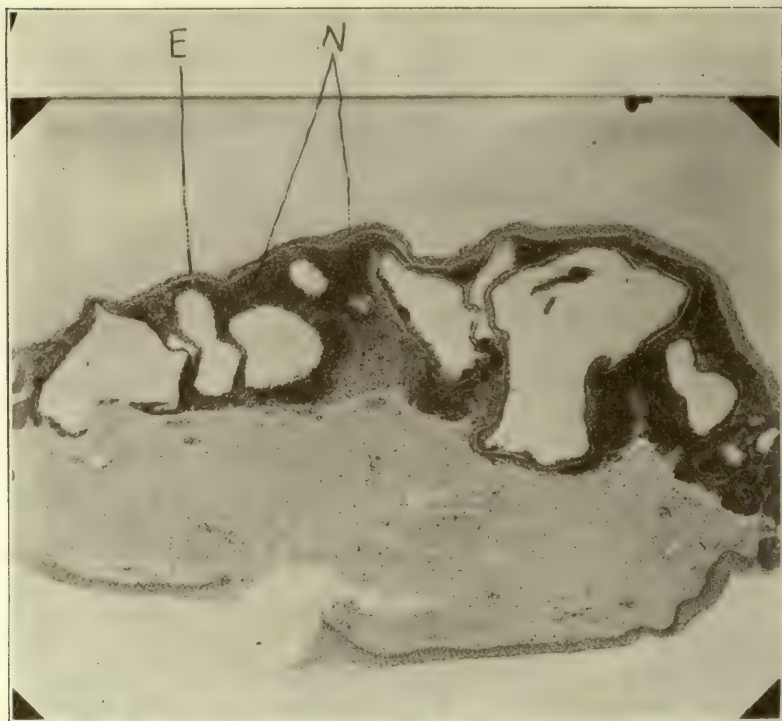


Fig. 4. Cystic nevus. E, surface epithelium; N, nevus cells.

cyst. In other places, this lining is finely irregular, due to the cytoplasm not filling out the spaces between adjoining nuclei to a common level. The cyst cavities are empty except for a few nevus cells and a little serum in several of them.

The explanation of cyst formation in these sections is probably the inability of the blood supply to keep up with the growth of nevus or of epithelial cells. Hence the cells degenerate and disappear from the center and even over large areas, as in this specimen under discussion.

At the sides of the main nevus cell mass, are the only places where there exists a close association between nevus cells and epithelium. Here (Fig. 5) are found nevus cell inclusions within the surface epithelium and other groups of nevus cells (some of which are quite large) lying with their outer cells in the position of the basal epithelial cell layer, which is absent in these places. Nevus cells moderately filled with pigment are present in small amount at these latter places, although they are met with very infrequently through-

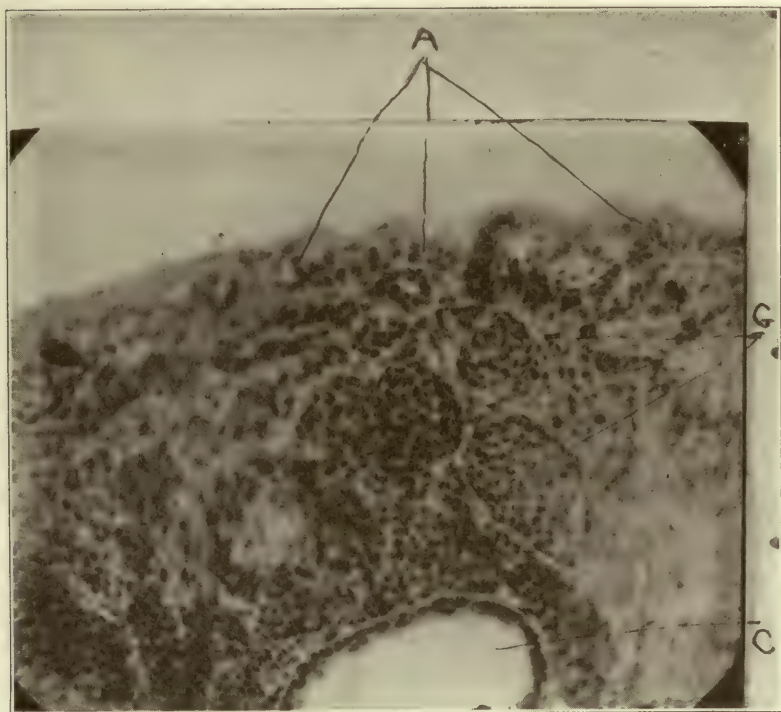


Fig. 5. Nevus cell groups in close association with surface epithelium as at A. G, nevus cell groups; C, cyst.

out the cell mass. The pigment, although small in amount, is undoubtedly sufficient to justify the designation of pigmented being applied to this cystic nevus.

The last specimen shows distinctive points of interest. It was excised from the skin on the outer part of the lower eyelid of a man of fifty-six years, a patient of Dr. F. L. Henderson. This growth was a recurrence of one removed one year previously. The patient had noticed the growth recurring for

about two months before consulting Dr. Henderson. Excision was made deep into the eyelid, going well into surrounding normal tissue.

**MICROSCOPIC FINDINGS:** The sections were made across the skin, orbicularis muscle and some of the tarsus, containing many acini of Meibomian glands.

The diagnosis of basal cell carcinoma is amply justified from the changes in the skin. Here are seen much proliferation of the cells in the rete Malpighii or stratum germinativum,

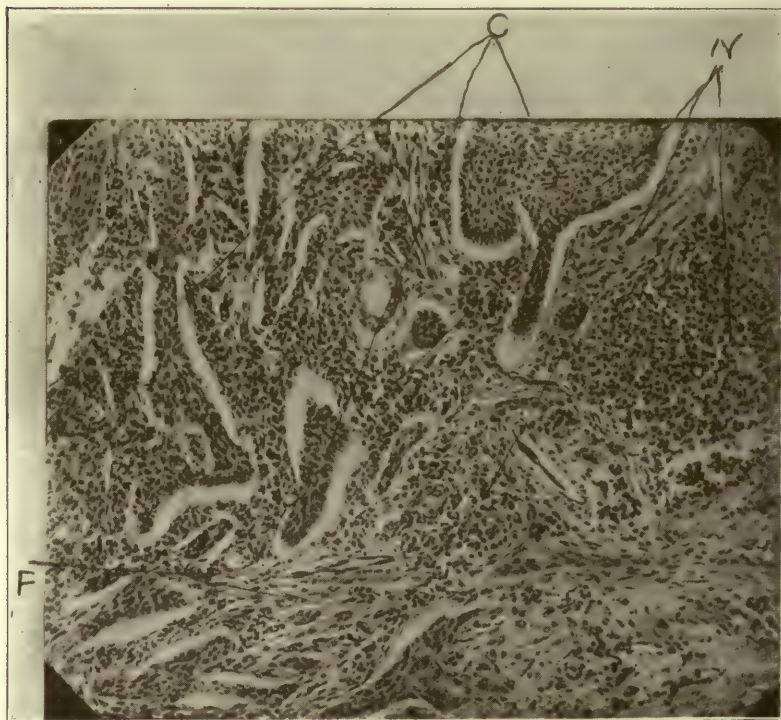


Fig. 6. Basal cell epithelioma containing nevus cells. C, epithelial cell islands; N, nevus cells; F, muscle fibers or orbicularis.

forming in the cutis many nests of epithelial cells with no pearls. These cell nests occur as narrow columns, frequently bifurcating, or as small, round or oval groups of epithelial cells. This proliferation has progressed to among the muscle fibers of the orbicularis.

In the connective tissue between the cell islands (Fig 6), there are found nevus cells, though not in great numbers. As we go deeper into the tissue they become more frequent, being

present in large numbers in front of the muscle fibers and also between them. Just behind the muscle, at the middle of the growth, the nevus cells lie in greatest profusion. The arrangement of these nevus cells throughout is that of irregular shaped loose groups, with a scanty intercellular fibrous network; there is no alveolar grouping or connective tissue bands belonging to these cells. The individual nevus cell bodies are quite large, and their outlines can be readily made out in many places. There is no apparent connection between the nevus and epithelial cells. A very few pigmented nevus cells are present.

From our sections in this case, the nevus cells apparently play but a minor or side part. The epitheliomatous cell nests are seen coming from the basal epithelial cells, as is the rule.

In conclusion, will quote from Ewing<sup>14</sup>, whose chapter on melanoma is the most searching and advanced review on this subject in the literature. He states that melanoma undoubtedly arises from nevus cells, and the histologic signs point very strongly toward the origin of nevus cells from the epidermis. The relation of chromatophores to the nevi-melanoma is not yet clear. The theoretic considerations favor the origin of all melanomas from the mesoblastic chromatophores, while the histology of human tumors favors the origin from epithelial cells which have taken on pigmentary functions. He says that until more light is thrown on the nature of the supposed epithelial changes in congenital nevi, a final decision may be withheld.

#### BIBLIOGRAPHY.

1. MacCallum. Textbook of Pathology, 1920.
2. Kaufmann. Pathologic Anatomy, 1911.
3. Wolfrum. The Nevus of the Ocular Conjunctiva and of the Choroid, and its Relations to the Melanotic Tumors. *Archiv. für Ophthalmol.*, 1909, LXXI, page 195.
4. Birch-Hirschfeld. The Melanotic Tumor of the Eye and its Surroundings. *Zeitschr. für Augenheilk.*, 1921, Bd. XLIII, page 201.
5. Ribbert. Tumors, 1904, page 277.
6. Unna. Histopathology of the Skin Diseases. In Orth's Textbook of Special Pathologic Anatomy, 1894.
7. Della Favera. Contribution to the Knowledge of Pigmented Nevi. *Ziegler's Beiträge zur pathologischen Anatomie und allgemeinen Pathologie*, 1908, XLIII, page 43.
8. Kromayer. Reply to the Claim of Prof. Ribbert in his paper on Melanosarcoma. *Ziegler's Beiträge zur pathologischen Anatomie und allgemeinen Pathologie*, 1897, XXII, page 412.
9. Judalewitsch. *Archiv. für Dermatologie*, 58.
10. Salzmann. Anatomy and Histology of the Human Eyeball in Normal State, 1912.

11. Saemisch. Handbuch der Augenheilk, 2 Auflage, V Band., 1 Abteil, 1904, page 629.
12. Meirowsky. The Origin of Pigment in the Epidermis of Man from the Substance of the Nuclear Bodies. Monatsheft. für praktis. Dermatolog. Bd. 43, 1906, page 155.
13. Dyson. Cutaneous Pigmentation. Brit. Journ. of Dermatology, XXIII, page 205.
14. Ewing. Neoplastic Diseases, 1919, page 849.

#### DISCUSSION.

DR. WM. C. FINNOFF, Denver Colo.: We should thank Dr. Lamb for the thorough method in which he has studied and presented this subject. I think the time is coming when the ophthalmologist will have some training in pathology. We all should understand the changes which take place in tumors and other pathologic conditions of the eye. There has been a good deal of discussion as to the origin of tumors of a nevoid character which contain pigment. The greater number of these tumors undoubtedly arise from epithelium. The cells resemble the basal epithelium and contain the pigment. Some, however, do not, but arise from connective tissue. Some general pathologists state that melanosarcomas arise from these. I have two specimens of the epithelial type, and a third in which the cells resemble chromatophores. The third specimen shown by Dr. Lamb is a lymphangioma. I think that the large spaces which he has described as cysts are lymph channels.

DR. H. D. LAMB, St. Louis (closing discussion): One is certainly repaid for studying the microscopic appearances of the epibulbar growths. In my experience the great majority of these have been papillomata and nevi, both of which are benign in character. So delicate are the periocular structures, that paraffin sections from these growths can be made very thin and beautifully stained.

## NONSURGICAL TREATMENT OF MALIGNANT EPIBULBAR NEOPLASMS.

EDWARD B. HECKEL, A.M., M.D., F.A.C.S.

PITTSBURGH, PA.

While malignant epibulbar neoplasms are not common, yet they are so important that they should command our closest study. Prior to the advent of the Roentgen ray and radium, surgery offered the only means of treatment. The usual procedure was an excision of the neoplasm, and in most, if not all, of the cases a rapid return of the growth, followed later by an enucleation and not infrequently by a total exenteration of the orbit, and as a rule all without control of malignancy. It may be good surgery to excise all malignant growths, provided they can be excised completely and the cutting procedure limited to the surrounding healthy tissue. It goes without saying that epibulbar neoplasms do not provide these conditions. The space is limited and all the tissue valuable; none should be sacrificed. The principal commandment of the cancer decalogue is "do not cut across a cancer and leave a part behind. The part remaining will grow more rapidly than if it had been let alone altogether." In the Roentgen ray and radium emanations we have two agents which undoubtedly produce a selective necrosis of malignant tissue.

Prior to 1910 our results in the treatment of these cases with the Roentgen ray were not very flattering, especially as to the preservation of a functioning eye. Most of these cases resulted in a sloughing of the cornea as a result of drying, due to long exposure under the Roentgen ray.

At the meeting of our Academy in Chicago in 1915, it was the writer's privilege to report a case of epibulbar sarcoma, treated with Roentgen ray in 1910, with a technic which resulted in a complete cure of the malignancy and the preservation of a perfectly functioning eyeball. The success in this case was, the writer believes, the result of keeping the anterior segment of the eyeball wet during the exposure to the Roentgen ray, by the continuous dropping of a normal salt solution over the eyeball. Since then, we have been able to discard the salt solution due to better and more efficient X-ray tubes. The technic employed in the following cases consisted

of placing the patient in a recumbent, comfortable position. The face was covered with a piece of tin foil, perforated with a small hole, a little larger than the neoplasm and so placed, that when the patient was directed to look in a certain direction, the aperture in the tin foil was directly over the neoplasm. This procedure permits the patient the free use of the eyelids, so that he may wink as often as he desires; in this manner the cornea is kept moist and can not dry.

Case 1. A. L. R., aged 71 years. Referred by Dr. McMur-ray of Washington, Pa. Patient first noticed "a small lump" on his right eye about one year ago; it had been growing gradually till it presented the appearance shown in the illustration. The eyes were negative in every other respect. R.V. = 20/30 with +2.25 D. S.; L.V. = 20/30 with +1.00 D. S.  $\subset$  +0.50 D. C. ax 60°. A small piece of the neoplasm was excised and examined by Dr. Haythorn of the Singer Memorial Research Laboratory of the Allegheny General Hospital, with the following result:

"Section from the corneoscleral junction. Serial sections were made through the whole piece of the tissue removed. A bit of sclera shows an intense infiltration with plasma cells. The portion nearest the cornea contains several papillary outgrowths, with well developed epithelial pearls. The cells near the lower portion of the epithelial layer are atypical, picnotic, and show well developed intercellular ridges. At the end nearest the cornea, the cells show atypical arrangement with the formation of concentric epithelial bodies in their lowermost layer. As no stroma is present beneath the layer, it is impossible to say whether actual invasion has taken place or not.

Diagnosis: Epidermoid carcinoma.

The Roentgen ray was applied by Dr. G. W. Grier as follows: First application over the lesion, as above described, was made with 5 M. A. current at a voltage corresponding to 6 1/2 inch parallel spark gap; the distance from anode of tube to lesion was 8 inches; no filter of any kind was used. This current was applied for 2 1/2 minutes. Second exposure, five days later; the same treatment was applied. Third exposure, three days later; the same treatment was applied, except that the exposure was three minutes long instead of 2 1/2 minutes. Fourth exposure, four days later; the same treatment as that of third. After this series of treatments, the patient was given

a rest of twenty-one days. At the end of this time, there was still a small part of the growth remaining. Treatment was then again resumed (fifth exposure) twenty-four days after the fourth exposure; the same technic was used, except that this time the tube was ten inches from the lesion and the length of treatment was extended to 3 1/2 minutes. Sixth exposure, three days later; he was given a similar treatment at 10 inch distance; the length of treatment was three minutes. Seventh exposure, two days later; he was given the same treatment as the fifth exposure. One month later the lesion had completely disappeared, and remains so.

Case 2. G. W. S., aged 61 years. Patient first noticed "a small lump" on right eyeball about six months ago; growth quite rapid within the last four or five weeks, when it presented the appearance shown in Fig. 4. Otherwise the eyes were negative. R.V. = 20/40; L.V. = 20/40. A piece of the neoplasm was excised and examined by Dr. Alter of the Western Pennsylvania Hospital with the following result:

"Specimen consists of small nodule, 3 mm. in diameter. It is quite firm. Section of the small nodule shows irregular proliferation over the surface epithelium, and covered with hemorrhage. The section is diagonally, and the nature of the invasion is not very clear.

Diagnosis: Squamous cell carcinoma."

Dr. G. W. Grier applied the Roentgen ray as outlined above: First application over the lesion as above described was made with 5 M.A. current at a voltage corresponding to parallel spark gap of 6 1/2 inches; the distance from the lesion to the anode on the tube was 9 1/2 inches; no filter of any kind was used. The exposure lasted 3 1/2 minutes. Second exposure, two days later, under the same conditions. Third exposure, four days later, same technic. Fourth exposure, two days later, same technic. Patient was then given a rest for nineteen days, and as some of the neoplasm remained he was given the fifth exposure, with same technic, except that the time was extended to four minutes. Sixth exposure, three days later, same technic. Seventh exposure, four days later, same technic. Eighth exposure, two days later, same technic. After this, the patient was given a rest for twenty-three days, when the lesion had almost disappeared, but as some remained he was given the ninth exposure, with the same technic. Tenth exposure, two days later, the eleventh exposure, and

three days later the twelfth exposure. All trace of the neoplasm has now disappeared.

Summary of treatment in the first case seven treatments or exposures in all,

First exposure

Second exposure, 5 days later

Third exposure, 3 days later

Fourth exposure, 4 days later

Rest of twenty-one days.

Fifth exposure 21 days after fourth exposure

Sixth exposure, 2 days later.

Seventh exposure. 2 days later

Total exposures, seven; time consumed, thirty-five days.

Summary of treatment in the second case:

First exposure,

Second exposure, 2 days later

Third exposure, 4 days later

Fourth exposure, 2 days later

Rest of 19 days.

Fifth exposure, 19 days after fourth exposure

Sixth exposure, 4 days later

Seventh exposure, 4 days later

Eighth exposure, 2 days later

Rest of 25 days.

Ninth exposure, 28 days after the eighth exposure

Tenth exposure, 2 days later

Eleventh exposure, 2 days later

Twelfth exposure, 3 days later

No trace of lesion.

Total exposures, twelve; time consumed, seventy days.

While the results in the reported cases by the writer are all that could be desired, and therefore surgical interference not justified in similar cases, he is not unmindful of neglected cases where the neoplasm projects through the lid aperture as a cauliflower growth. In such cases it would be well to excise the protruding mass with the actual cautery, heated to a cherry red heat, and then follow this immediately with Roentgen ray or radium.

#### DISCUSSION.

DR. LEE MASTIN FRANCIS, Buffalo, N. Y.: I think Dr. Heckel is to be congratulated upon his excellent results. However, the effects of the X-ray and radium on the deeper ocular structures are not good oftentimes, and I feel very strongly that there is a field for surgery here. I think the failure of the surgical attack on growths of this sort is

frequently due to the lack of a thorough going technic. I believe that these epibulbar growths, if not too extensive and too deep, are approachable by surgical technic. This is bound to fail, however, if one does not start after them with some well planned method. I have reported a few cases of technic in Knapp's Archives several months ago. I believe one should make an incision in the cornea, outlining the growth, and make it deep enough to include all but the last layer, and beginning with the corneal flap, work backward and inward with these tissues according to surgical principles applicable in other parts of the body.

DR. HECKEL (closing discussion): I have very little to add except that I think we should be very careful lest we fall into the error of false logic in attributing cases of cataract that have had the X-ray to this. It may follow, but not necessarily on account of it. The development of a cataract or opacification of a lens may follow, and yet it not be a causative factor whatever.

## BLEPHAROPLASTY FOR RESTORATION OF SOCKET.

WILLIAM C. FINNOFF, M.D., OPH. D.

DENVER, COLORADO.

It is not the purpose of this paper to advance anything original in plastic reconstruction of the eyelids, but to emphasize the value of some simple materials, which have been used rather extensively in the military facial reconstruction hospitals during the recent war. These have not been adopted very generally in civil practice, where they can be used with as much satisfaction and success as in military ophthalmology.

The use of molds, covered with skin, as supports in reconstructing the socket, was first described by Esser, who covered dental impression or modeling compound (dental stent) with Thiersch grafts, and buried them in the orbit through a skin incision. Waldron modified the procedure by enlarging the socket and burying the graft covered conformer in the orbit without incising the skin, and Gillies developed the epithelial outlay and overlay. In 1919, Doctor McKee read a paper before this society on this subject and reported several cases. Since that time, Wheeler and others have written on the modern technic of reconstruction of the socket.

There is a group of cases in which the socket is partially obliterated by scar tissue, which prevents the insertion and wearing of an artificial eye. In some of these cases, the conjunctiva has not been lost, and all that is necessary is to reestablish the contour of the socket sufficiently to permit the insertion of a prothesis. If sufficient conjunctiva is present, the bands of scar tissue can be cut and held apart by a conformer until healing has taken place. A suitable artificial eye can then be inserted.

Dental impression compound is an ideal material to use for dilating purposes. It becomes pliable at 160° F., and a cast of the socket can easily be obtained by forcing the soft compound between the lids either before or at the time of the operation. If more support is needed in a certain direction, the cast can be built up as much as is desired. I have done this in several cases with gratifying results. Paraffin or wax can also be used for this purpose.

The following case illustrates the usefulness of conformers in civil practice: G. S., age 32 years, automobile mechanic by occupation, was injured by a flying blade from an auto-

mobile tan on June 17, 1920. The blade tore completely through the lower  $1/2$  of the left upper eyelid, at the junction of the inner  $2/3$  with the outer  $1/3$ ; it perforated the eyeball, cut completely through the lower lid at the junction of the inner  $1/3$  with the outer  $2/3$ , and lacerated the cheek obliquely downward to the left ala of the nose. A general surgeon enucleated the eye and attempted to approximate the edges of the wounded lids. When first seen by me, eight months after the accident, the patient had an unsightly deformity of the left eyelids and cheek. The upper lid was notched and puckered, and it was drawn backward into the orbit by a firm band of scar tissue. The lower lid was pulled markedly



Fig. 1.

downward by the scar in the cheek (Fig. 1). This scar was firmly attached to the lower border of the orbit. The conjunctiva of the socket, which bulged between the lids in the outer  $1/2$  of the orbit, was inflamed and roughened because of exposure. An artificial eye could not be inserted.

The socket was cleansed carefully several times a day, and a 1% solution of mercurochrome 220 used as an antiseptic until the pus had disappeared. The first step taken toward correcting the deformity, was the making of a cast of the existing socket. The cast was built upon (Fig. 2-B.), so that it would apply pressure up and out in the region corresponding to the cicatricial band which retracted the upper

lid. In the first operation the conjunctiva was punctured near the margin of the lid, and the cicatricial band cut with scissors as high as possible. The conjunctiva was then loosened. This reestablished the upper cul de sac. The conformer was then

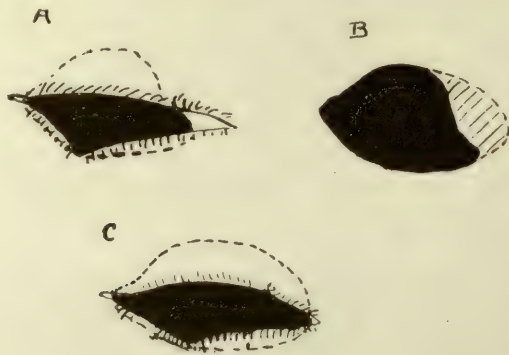


Fig. 2.

inserted and held in place by a pressure bandage. The bandage was removed and the lids cleansed daily for a week. A

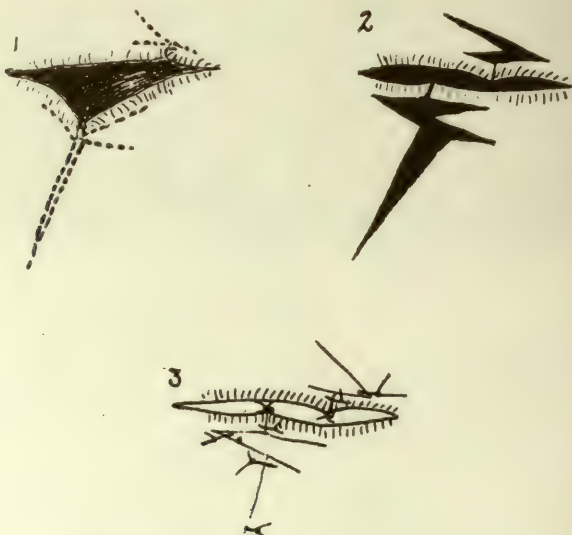


Fig. 3.

small artificial eye was then used, the socket cleansed frequently, and mercurochrome instilled.

Three weeks after the first operation, a plastic operation was done on the eyelids (a modified hare lip procedure) (Fig.

3). The patient was put under a general anesthetic. The scar which held the lower lid to the orbital margin was completely severed, and the skin of the cheek was extensively undermined to relieve the tension. The lid margins were overcorrected. Several medium sized and fine dermal sutures (B. & B. Co.) were used. The wound was dusted with iodoform powder, and no dressing applied. Several stitches were taken out after twenty-four hours, and at the end of the fourth day, all had been removed. A small artificial eye was then worn to prevent contraction. The outer portion of the socket was still shallow and caused the cornea of the artificial eye to rotate inward. March 27, 1921, a third operation was done in the outer portion of the orbit. A technic which was similar to the first operation, was employed. A



Fig. 4.

conformer of dental modeling compound was used for ten days, after which time, the artificial eye which he has worn ever since, was inserted (Fig. 4).

In this case, epithelial inlays were not used, because the conjunctiva had not been destroyed. All that was necessary was to place the mucous membrane in its proper position and hold it in place until healing occurred.

I wish also to emphasize the value of a single strand suture material in plastic operations about the eyelids. Wounds which involve the margins of the lids are constantly moistened by tears, which retard healing and predisposes to infection. Sutures in the region of the lid margin are bound to carry tears and infectious material into the wound by capillary at-

traction, and an attempt should be made to minimize this danger. Plain silk and other multiple strand sutures act as wicks, and are purveyors of infection; and the care in sterilization at the time of operations, is defeated later. Single strand sutures, i.e., horse hair, silk worm, dermal sutures, etc., reduce this danger to a minimum, and should be employed more extensively in plastic operations about the eyelids.

#### DISCUSSION.

DR. GEORGE H. CROSS, Chester, Pa.: An interesting phase of plastic surgery of the eyelids and orbit is one's ability to arrive at a successful result by several different paths. Dr. Finnoff is to be congratulated on his remarkably good result with this case. It is unfortunate that Dr. Wheeler is unable to be present, and tell us about the use of the Wolfe or free lid graft with which he has been so successful.

Last Spring I had the pleasure of talking with Dr. Imre of Hungary who had performed over 700 plastic operations, using principally the sliding graft. Some of his most excellent results were shown in an article in the *Journal of the A. M. A.* He has a unique method of separating the deep fascia and suturing it separately, which holds the skin graft in splendid position. Most of his cases had a marked ectropion, but in no case the entire loss of lid border. I think the method that bespeaks the best success, where lid border is lost, is by the use of the pedunculated graft, especially so when a new lid and cul de sac has to be formed.

At the Cape May Army General Hospital, No. 11, there were a number of cases in which the entire lid was destroyed, and the conjunctiva retracted onto the external surface of the cheek. In these cases, it was necessary to first supply the eyelid, before we constructed the new cul de sac by means of an "Esser tunnel."

Dr. V. P. Blair of St. Louis was the first to bring to our attention the practical use of "stent" or modeling compound when he returned from France, where he was in charge of the oral plastic service of the A. E. F.

I am sure we all agree with Dr. Finnoff in the use of modeling compound in enlarging the sac. With a little hot water you can change the size and shape of your conformer at a moment's notice. Another very successful use of modeling compound is as a dressing for the area from which the Theirsch graft was removed. Patients often complain more about their arm or leg, as the case may be, than the eye, and we found they were made much more comfortable by applying the compound when soft, directly on the denuded area, and covering with a roller bandage.

DR. JOBSON, Franklin, Pa.: In 1905 I presented before the Pennsylvania Society the question of plastic surgery on the lids. I have since done a considerable number where I live, where men are subjects to burns from oil. I have compared successes and failures, and will describe a case out of the ordinary. A similar case was described by Dr. Gillies in his work on plastic surgery of the face. A young man in service, a shot entering back of the ear and passed forward taking the ear and the bony socket. He was operated on twice in the army by

surgeons who had not taken care of the bony socket, and the lid drooped so he could not retain an artificial eye. We dissected the scar tissue underneath and undermined the skin, making a V-shaped cut in this way (illustrating), cutting down the subcutaneous tissue until we reached the broken piece of the bone; drilled two holes and then with a piece of osseous cartilage to fit in this hole (illustrates) inserted a piece of catgut through the cartilage and bone and bound and secured it in place, and sewed in another piece of cartilage here, and then stitched this up in this manner, making it Y-shaped instead of V-shaped, and pulled the lid up. I saw the man lately and he looks natural and wears and retains an artificial eye.

DR. E. B. HECKEL, Pittsburgh, Pa.: It has been my privilege to have done this operation on a number of orbits by means of a one piece epithelial graft, and my technic is a little different. I use an absorbent cotton wad packed together into a solid mass, as much as will fit into the orbit, to force the raw surface apart. After this is the size we desire, we cover with a piece of rubber dam (illustrates) and tie with a strong slip suture that shuts out anything coming into contact with the cotton, and we get a surface that is aseptic and smooth, and the epithelium of the graft will not stick to the rubber dam. The lids are held down with a pressure bandage for five to seven days, and after that cleansed daily, and the results have always been good. We cover with sterile gutta percha and a bandage for five days, and have no trouble or complaint of pain. Then dress with bichlorid, 1 to 3,000.

DR. GEORGE C. SCHAEFFER, Columbus, Ohio: My excuse for taking part in this discussion lies in the fact that while Dr. Wheeler was in charge of the Eye service at Ft. McHenry, I had charge of the larger plastic work of the face, restoration of the nose, ears, lips, chin, etc. It, therefore, became necessary for me to do considerable work in eye plastics. Injuries to the eye were very often complicated by loss of portion of the inferior orbital margin. Where the eye was lost and the socket or lids were to be restored, the first essential was the repair of the orbital margin. This was done by taking a piece of costal cartilage, cutting it the size and shape of the defect, and placing it next to freshened bone. I lay stress on the last point, because unless the cartilage is brought into direct contact with freshened bone it will not become solid and afford support for the prosthesis.

With the orbital margin restored, we can proceed to the restoration of the socket and lids, knowing that when ready for the prosthesis, it will be supported in normal position. If the lid margins remain and there is any mucosa, repair can usually be made by the use of Wolfe grafts, the skin from the inner surface of the upper arm being best for this purpose. The bed must be carefully prepared, the graft cut at least one-third oversize, carefully sutured into place, and dressed with a firm dry dressing, being particular to hold the graft in close contact with the bed. If the graft is large, it is usually wise to perforate it in a number of places so that any secretion forming under it may have an easy means of escape. Where nothing has been left of the lids, a large skin flap must be transferred, and later the socket made by epithelial inlay. It has been my practice to put my inlay in the socket of an artificial eye, instead of using the modelling compound. The artificial eye affords a smooth

surface, is easily rendered sterile, and gives shape to the new socket for the prosthesis which is to follow.

DR. ROBERT SCOTT LAMB, Washington, D. C.; In these cases of distorted eyelids, there is a desire for the best cosmetic effect, and to obtain the results taxes the ingenuity of the operator about as completely as any other eye work. I want to report the case of a young woman who had the removal of three sebaceous cysts from the orbit. I did not know I had a multiple cyst to deal with. I went by way of the outer canthus the first two operations and then decided to do a Krönlein. As a result, one stitch abscess caused a fistula passing back into the orbit. The last tumor was about an inch and three-quarters in length. She still has perfectly good vision. There was a retraction of the upper lid which caused a good deal of deformity and a certain amount of exophthalmos, and the question was where to get the tissue to fill in that area which would be made vacant by the removal of the scar. After removing the scar I had a triangular deformity. I cut a piece of skin from the thigh and plugged it the same as you would a watermelon, and got a good deal of fat with it and filled the hole. The result was perfectly satisfactory in every way. You can go elsewhere for your tissue if you need it, rather than take the tissue about the eye.

DR. W. C. FINNOFF, Denver, Colo. (closing discussion): In sterilizing the dental modeling compound, one cannot boil it as it loses its pliability; bichlorid 1 to 3,000 should be used. In some cases an artificial eye may be used; it is an ideal material. This paper was intended to bring this subject to the attention of the ophthalmologist in civil practice.

## SOME PRACTICAL POINTS IN BLEPHAROPLASTY.

WALTER R. PARKER, M.D.

DETROIT, MICHIGAN.

No attempt will be made in this paper to cover all the plastic operations on the lid. A few cases will be discussed illustrating the method of cutting the grafts and the after treatment employed.

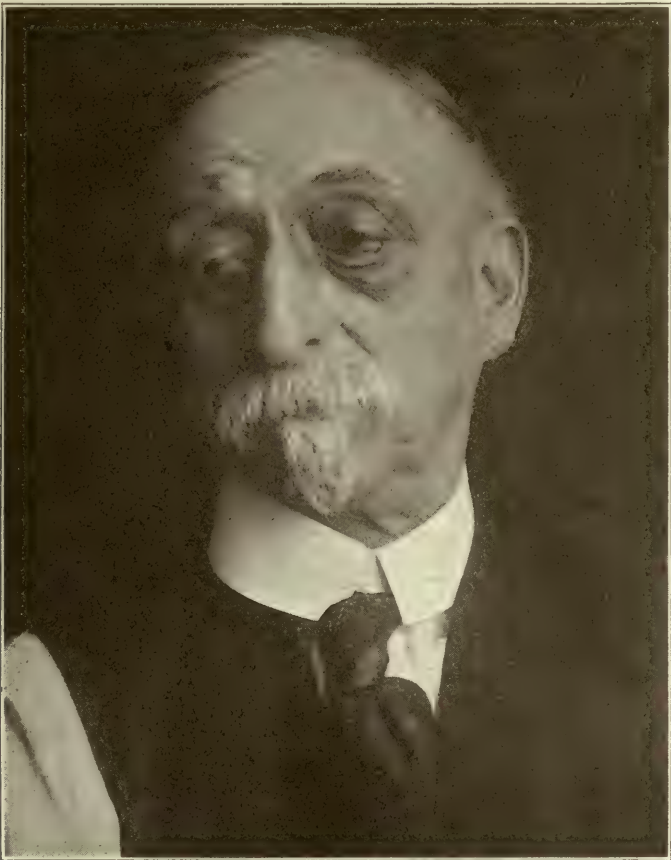


Fig. I. Senile Ectropion. Before Operation.

The first case is one of senile ectropion in which, through faulty technic, only a fair result was obtained. (See Fig. I and 2.) Some text books illustrate the incision that forms

the base of the triangular piece of skin to be removed, as running directly out from the canthus. Better average results will be obtained if the line of this incision runs up and out, at an angle of  $45^{\circ}$  (A-B Fig. 2). By this means the skin of the lid is drawn up and out, and there is less likelihood of the outer portion of the lid sagging. Another point in this

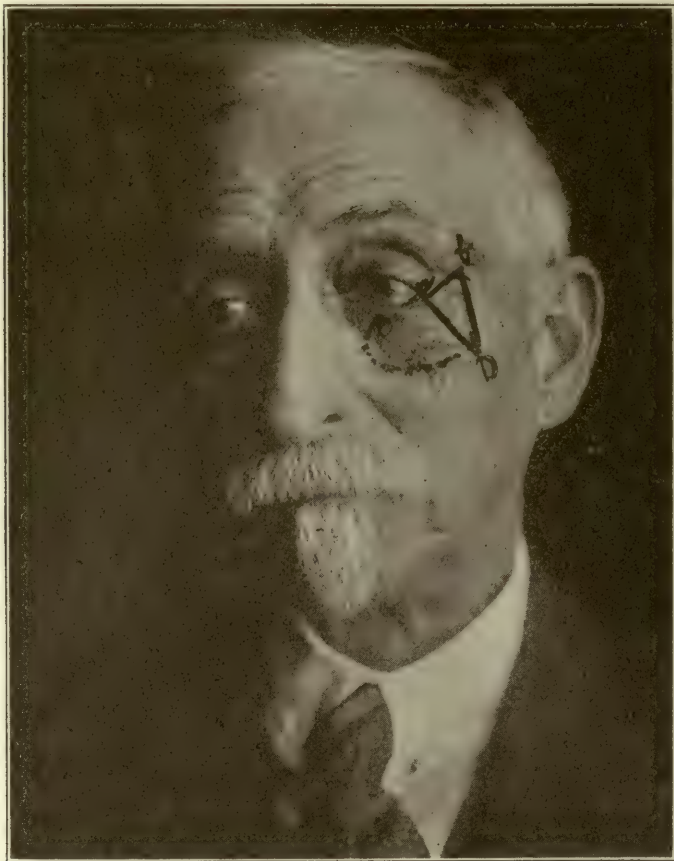


Fig. 2. Senile Ectropion. After Operation.

operation is to undermine the skin of the lid well down on to the cheek, and nasally beyond the vertical line passing through the inner end of the incision in the lid margin (C-D, Fig. 2). This procedure enables one to slide the skin over and up without undue tension, and therefore with less likelihood of final sagging of the lid at the outer canthus.

The second case shown is one of cicatricial ectropion of

the right lid, following a wound produced by the bite of a horse (Fig. 3). The whole right lower lid was everted and held in this faulty position by a superficial scar.

To correct this deformity, an incision was made throughout the entire length of the lid, 2 or 3 mm. below its margin.



Fig. 3. Cicatricial Ectropion. Result of Horse Bite. Before Operation.

The everted portion of the lid was undermined, turned upward over the upper lid, and held in this position by two sutures inserted in the edge of the lid, and attached to the brow above by the use of adhesive plaster. Care should be taken in the introduction of the suture, because if the lid margin is included and the suture pulls through, a permanent notch may result. An epidermal graft was cut from the inside



Fig. 4. Cicatricial Ectropion. Immediate Result.



Fig. 5. Cicatricial Ectropion. Final Result.



Fig. 6. Result of Dynamite Explosion.



Fig. 7. Cicatricial Ectropion. Result of Dynamite Explosion.



Fig. 8. Immediate Result. Thin Graft Right Eye, Whole Skin Graft Left Eye.



Fig. 9. Final Result. Thin Graft Right Eye, Whole Skin Graft Left Eye.

of the arm after the ordinary preparation had been made, except that the skin and razor blade were smeared with a thin coating of sterile vaseline. The whole surface exposed was covered with a thin graft and no dressing applied, nor were sutures introduced. The appearance of the lid at the end of seven days is shown in Fig. 4, and the result six months after the time of operation in Fig. 5.



Fig. 10. Cicatricial Ectropion. Result of Gasoline Burn. Before Operation.

A third case, the result of a dynamite explosion in a coal mine, is shown in Fig. 6, and the resulting cicatricial ectropion and leucoma in both eyes are shown in Fig. 7.

The operation in this case was similar in every respect to that performed in case two, except a whole skin graft was sutured in position on the left lid. The immediate result is



Fig. 12. Remote Result of Case Shown Fig. 10.



Fig. 11. Immediate Result in Case Shown in Fig. 10.

shown in Fig. 8. The final result was about the same in the two eyes, the only difference being more time was required for the whole skin graft to assume a normal appearance than had been required for the thin graft (Fig. 9).

The fourth case was one of a severe gasoline burn in which, due to cicatricial contraction, the lower lid in the right eye and both lids in the left were completely everted, and the right upper lid was partially everted, as shown in Fig. 10. At the first operation both lower lids were dissected up and treated as in case two, and a week later, both upper lids were freed and drawn down over the lower lid and attached to the cheek. Thin skin grafts were used to cover the exposed surfaces. The result three weeks after operating is shown in Fig. 11, and after six months in Fig. 12. The result was satisfactory in the left eye, but further operative procedures were required in the right eye. A photograph of the final result was not obtained.

The fifth case is one of cicatricial ectropion following the use of paste treatment for supposed cancer. The operative procedure was the same as in case two. The appearance before and after operation is shown in Figs. 13, 14 and 15. The special interest in this case is in the appearance of the graft. The whole surface was very uneven for several days, as shown in Fig. 14. The final result was good but the time of recovery was longer than would have been required had a pressure bandage been applied over the dressing. The result eighteen months after time of operation is shown in Fig. 15.

In general, it appears to be better to apply dressings to thin skin grafts, unless the surface to be grafted is smooth, in which case it seems to make no difference with the final result whether pressure be applied or not. If a dressing is to be applied, narrow strips of gutta percha tissue, slightly overlapping, may be placed over the grafts, and the gauze and bandage are applied. This "shingling" method enables one to remove the dressing gradually with less risk of disturbing the graft. Dental moulding material may hold the graft in place in a most satisfactory manner. After the surface to be grafted is exposed, an impression may be taken with dental moulding material, or a mixture of equal parts of paraffin and beeswax. After the mould is set, it can be turned over, the whole contact surface covered with a thin graft, and the mould replaced. Over this a gauze and bandage dressing is applied in the usual way. This mode of dressing tends to



Fig. 14. Immediate Result Showing Roughened Surface of Thin Graft. No Dressings Applied.



Fig. 13. Cicatricial Ectropion. Before Operation.

spread out the exposed surface, and thus permit a larger graft to be applied. For obvious reasons, care should be taken not to permit the dental material to come in contact with the cornea. It is important not to disturb the dressing for five or six days.

In preparing the surface to be grafted, all scar tissue should be removed, and all bleeding controlled. The use of



Fig. 15. Final Result in Case Shown in Fig. 13.

vaseline facilitates the cutting of the graft, prevents its curling up, and does not interfere with the reading process.

The sixth case illustrates the operation performed for the restoration of the entire lower lid, after removal of an adenocarcinoma. (Fig. 16.) A Blasius operation was performed. The appearance of the wounds at the time of the first dressing

is shown in Fig. 17. When the patient left the hospital, the result, as far as the position of the lid was concerned, was satisfactory, but the graft was too thick, as shown in Fig. 18. The graft thinned as time went on, and while the final result was good, there is no necessity for using such a thick graft.

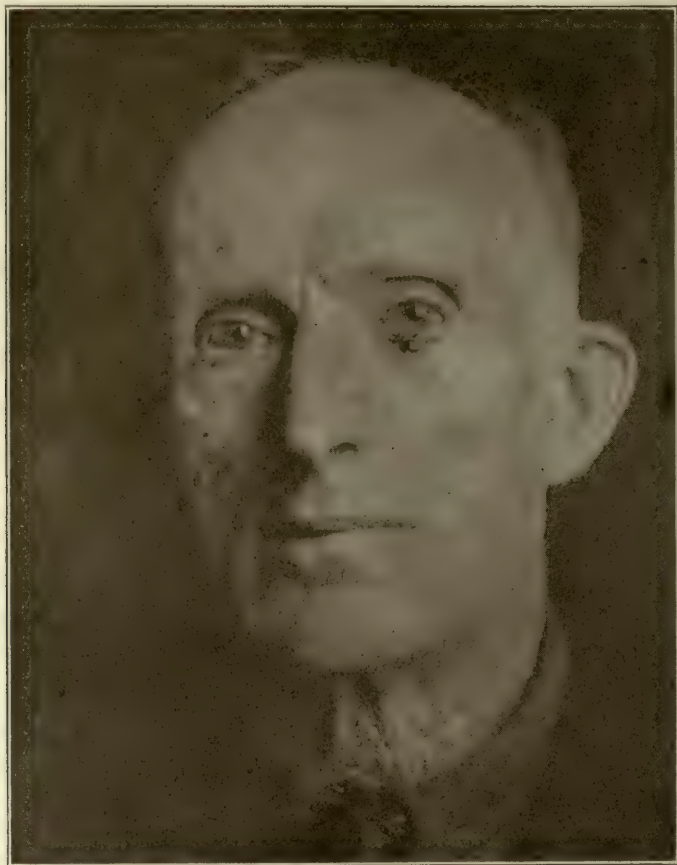


Fig. 16. Adinocarcinoma. Before Operation.

The seventh case, in which a similar operation was performed for restoration of the lower lid after removal of an epithelioma, shows a much better result. (Fig. 19.) In this case a thinner graft was swung down from the temple. Final result shown in Fig. 20.

In general, pedicled grafts taken from the temples for the restoration of the lids, have given more satisfactory final



Fig. 17. Complete Restoration of Lower Lid. Blasius Operation.

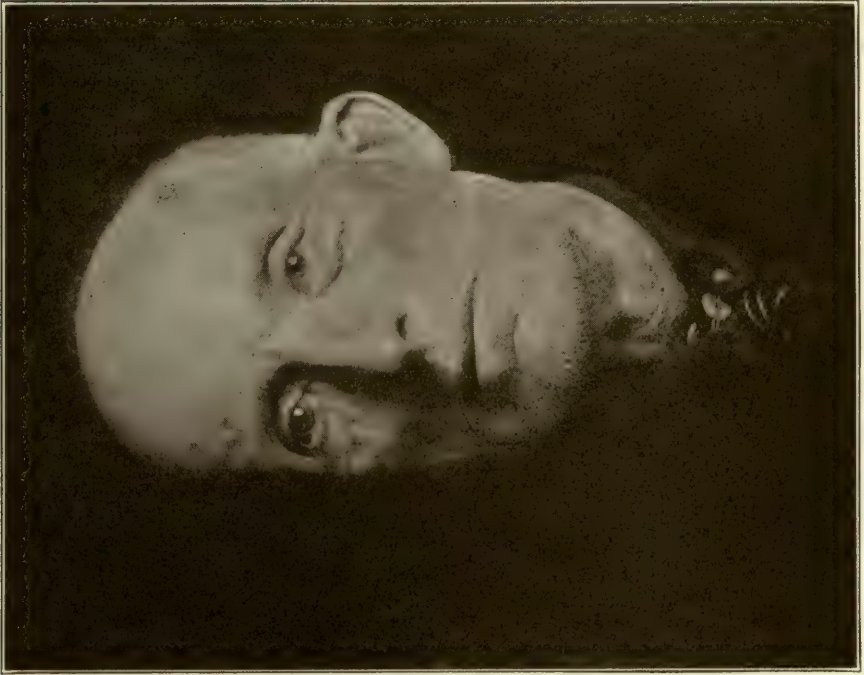


Fig. 18. Remote Result in Case Shown in Fig. 15. Graft too Thick.



Fig. 19. Epitheloma. Left Lower Lid.



Fig. 20. Final Result in Case Shown in Fig. 19.

results, than those obtained when the grafts were taken from the cheek. One reason for this is that the pull is up if the graft is taken from the temple, so that late contraction tends to narrow the palpebral opening, while if the graft is taken from below, any tension tends to pull the lid down, and thus expose the lower cul de sac.



Fig. 21. Microblepharon and Microphthalmus. Before Operation.

The last case is one of restoration of the orbit in a case of microblepharon and microphthalmus. The fissure was about one-half the length of the normal on the fellow eye. (Fig. 21.) The principal points in this operation were as follows: The external angle was divided to the orbital margin, the lid and skin dissected throughout in the usual manner to the orbital margin. A mould was made with dental mod-

eling material and covered completely with two thin grafts, taken from inside of the arm. It seemed as if the result in the outer half of the opening might not be satisfactory, as there was no suggestion of lashes or lid tissue present. Unexpectedly, however, this portion was a complete success, while the inner portion of the lid, which contained the tarsus, was



Fig. 22. Microblepharon and Microphthalmus. After Operation.

cut too thick, and required a second operation. (Fig. 22.) The final result, while not perfect, enabled the patient to wear an artificial eye.

It is important in operation for the restoration of the orbit to cut the lid thin, and extend the incision to the orbital margin in all directions. The tarsus may be ignored but all scar tissue should be removed.

## DISCUSSION.

DR. W. B. LANCASTER, Boston: My experience is much smaller than that of the previous speaker, and I should like simply to emphasize some causes of failure in plastic work around the lids.

Of course, in the first place, infection is a common trouble. I think some are apt to say that we cannot get this area aseptic; and they do not half try. There are bacteria in all these wounds, but they can be reduced in number. The quantity counts. Unless present in a sufficient number or dose, they fail to cause infection. So we can try to reduce the number, even if we do not succeed in entirely eliminating all microorganisms. On the other hand, if we use strong chemicals, we impair the vitality of the tissues. Strong iodine and bichloride, etc., are contraindicated.

The next thing to be avoided is the leaving of too much scar tissue. One speaker has several times said that he incised the scar tissue, but did not once say that he excised the scar tissue. Any scar tissue left is bound to contract; and you will not get as good results if you leave it. You should not be afraid to make a large wound in removing scar tissue.

With regard to making the graft take, perfect contact of the graft with the underlying tissue is a *sine qua non* of success. Any accumulation of blood underneath the graft is decidedly objectionable. First of all, it separates the two surfaces that are to grow together. Then, too, it is an excellent culture medium. Again, if there is much hemorrhage, the pressure will impair the circulation which is so essential to the nutrition of the flap. Then when the clot organizes, you have a thick scar tissue underneath the flap, which will act like all scar tissue and shrink. It is certain that hemostasis is important. That is another argument for a dressing with a certain amount of pressure to keep the graft thoroughly applied to the raw surface; namely, it will help prevent any possible secondary hemorrhage.

One of the cases shown illustrated the importance of perfect contact. By applying the Thiersch graft over the fresh cut, you get better results.

If you use the open method, with no dressing, you are supposed to get the graft to stick by means of the coagulation of the fluids between the graft and the bed; and you can observe conditions under the open method better than with a dressing. This does not make up for the lack of pressure and protection.

In making flaps around the lid, none of the speakers pointed out the importance of lining the lid. There is often enough conjunctiva to do that. Wheeler has shown that the best way to supply skin for a lid is from the opposite lid, if it is in a healthy condition. By an analogous procedure, one can take mucous membrane from the other eye to supply a small defect of conjunctiva. It is even possible to take a piece of tarsus from the other lid without its being missed at all.

A few years ago, in a paper on ptosis, I described an operation I had done once and wanted to get on record, of transplanting some fascia to make a connection between the frontalis and the lid. In a recent

German text book (Lexer) the same thing is suggested in connection with grafting operations. If you make a new upper lid by swinging a flap in, you can expect no motion if there is no levator; and he has transplanted fascia from the arm to connect the new lid with the frontalis, and found it satisfactory. This is an interesting example of independent invention of the same device, for it is more than doubtful if he ever read my article.

DR. GEO. H. CROSS, Chester, Pa.: I want to commend to you all the method of Dr. Parker in the use of vaseline applied to the skin area from which a graft is to be taken. It is far superior to the dry, the use of salt solution, or any other method I know.

The question as to the proper kind of a knife to use is answered by using that with which you get the best results. I happened to find an old knife among my father's effects, used forty years ago for cutting frozen sections for microscopic study. It is flat on one side and concave on the other, the blade about  $7/8$  inch wide by  $5\frac{1}{2}$  inches long, and it makes the finest instrument for cutting grafts I have yet seen.

I also wish to speak of the open method of dressing Thiersch grafts, by taking a roll of gauze about  $1/2$  inch in thickness and making a ring about  $2\frac{1}{2}$  inches in diameter which is applied by adhesive strips, and covered by a single layer of gauze, thus keeping all dressing away from the graft. Such a dressing permits frequent examinations.

To prevent separation of graft by blood clot, stab it full of holes; this permits the secretions to work to the surface. Do not use adrenalin in stopping hemorrhage; if too strong, it causes a slough.

Dr. Parker told me he intended to speak of sliding grafts, and to say that it is very essential to make the incision a curved line like a parabola, and to keep away from straight lines and angles in plastic work about the eye.

DR. JOBSON, Franklin, Pa.: As to what has been said in regard to dressing: we overdress frequently in these cases. There should be sufficient to prevent the flowing of serum. I make punctures to allow drainage. I arrived at the conclusion not to put on a dressing in hare lip work. I do hundreds of these cases and never put a dressing on, and never had an infection. I simply stitch it up and let the patient go home, securing the arm so they can't get it out. If taken from a distal portion of the body, I take twice the desired amount, putting in salt solution of 100 degrees. It will shrink, and you can force it in and get good approximation.

DR. FRED STAUFFER, Salt Lake City, Utah: I had a case of a young man with an acid burn of the eye, which caused an ankylosymbblepharon of the lower lid in the right eye, so that the lower conjunctival cul de sac was completely obliterated, and the ciliary margin of lid was attached to cornea up to lower margin of pupil. To relieve this attachment, a free dissection of the lid down to lower margin of orbit was made: A con-former, previously prepared from a thin piece of lead, cut in semilunar shape, and covered with a thin layer of paraffin, was then covered by a large Thiersch graft, with raw surface out, and placed into the newly made cul de sac, and stitched to the upper margin of lid. A light bandage was applied.

This made a beautiful restoration of the cul de sac. The graft covered the lower half of cornea and did not interfere with the sight.

The argument in favor of lead plates covered with paraffin is: they are easily made and can be used thinner than anything else mentioned in the discussion. If a round ball conformer is used, the cavity will contract as healing takes place, while the thin lead plate will retain the graft in the newly made cavity, and the mass of scar tissue in the bottom of the socket will prevent the artificial eye from sinking in. In preparing the lead conformer for restoring the whole socket, i. e., upper and lower lids, it is best to leave a hole in the center, to facilitate drainage; it also makes the removal of the conformer easier. I would like to know if there is any way to overcome the glistening appearances of the graft on the cornea?

DR. ROBERT SCOTT LAMB, Washington, D. C.: I would emphasize what Dr. Parker has said with regard to the preference for the temple or above the brow as the point of selection of the graft.

With regard to the difficulty of approximating without that buckling, he is right about the undermining. You can do this for three quarters of an inch from the incision. Before you sew your pedunculated graft, you draw it so it lies without tension at the extreme point where you take your first suture. So it fits without effort.

Dr. Stauffer makes a suggestion about lead plates. I had a case where an old negro's wife kindly threw lye in his face. I saw him a year later and he had an ankylosymbblepharon in both eyes, with opacities in the cornea. To get freedom from that feeling of binding, I dissected away the adhesions and then put in an oval conforming lead plate, 3 mm. thick, and so arranged it that the cornea could make an excursion in any direction without touching it. It does away with the necessity of a lot of plastic surgery. It will granulate up.

DR. C. E. WALKER, Denver, Colo.: About that lead plate: Dr. Wilder, of Chicago, described and read a paper before the American Medical Association with regard to senile ectropin. The best operation in my hands has been to slit the lids and make it far up as Dr. Parker stated. Make it far out and get a small portion of the upper and lower, stitching the upper section to the outer side, and it gives a fine cosmetic effect.

As regards cicatricial ectropin, Dr. Hotz (Three Essential Points in the Operation of Cicatricial Ectropin. Dr. F. C. Hotz, Journal of the American Medical Association, May 2, 1903) stated years ago that scar tissue contracts, and if you have scar tissue about the orbital cavity, these flaps are the best that can possibly be used, because they have already undergone contraction and conform to the condition of the anatomy around the lids.

DR. C. W. HAWLEY, of Chicago: I want to compliment the original speaker, and in regard to the doctor who asks how to overcome the glistening effect of the cornea; the simplest way is to not allow that graft to come up on the cornea at all. I have done a great many Thiersch grafts in the eye, and always cut out my graft in a curvature and round it,

to get to the edge of the scar on the cornea, and in that way the skin graft will not grow to the cornea and unless the burn is exceedingly deep, the cornea will restore itself in six months, and you can't tell where it is. For fear I might have the same result you had, I took a piece of conjunctiva and made a long flap extension and brought it out to the lower portion of the eye, to the edge of the cornea. There were good results and no scar at all in the lower portion of the cornea.

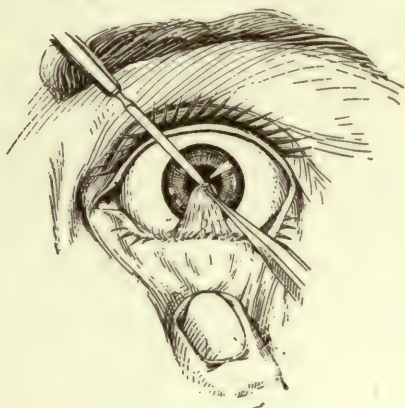
# THE REPAIR OF CERTAIN CASES OF SYMBLEPHARON ASSOCIATED WITH TRAUMATIC PTERYGIUM.

LEE MASTEN FRANCIS, M.D.

BUFFALO, N. Y.

This paper is concerned with certain cases of adhesion between the lid or lids and globe, in which there is also a connective tissue bridge extending to the cornea, forming a traumatic pterygium. Such conditions sometimes follow deep burns of the lids and eyeball, and require operative attack because of impairment of function. Two types are usually encountered, each requiring a somewhat different technic.

(Type A.) An adhesion between a lid (usually the lower), and the globe, with no involvement of a canthus.



TYPE A. (Fig. 1.)

(Type B.) An adhesion at a canthus (usually the inner), with involvement of both lids.

The method employed is that described by von Arlt, and quoted in most text books on ophthalmic surgery, with minor modifications.

1. The pterygium is dissected from the cornea in the usual way with a von Graefe knife. Instead of stopping at the limbus, the dissection is continued by the aid of scissors until the entire wedge is freed from the globe down to the fornix. Continuing with the scissors, a sufficiently wide pocket is fashioned under the skin of the lid, well *below* the level of the

fornix (Figs. 1-2-3). It is important to make this pocket deep to minimize subsequent contraction.

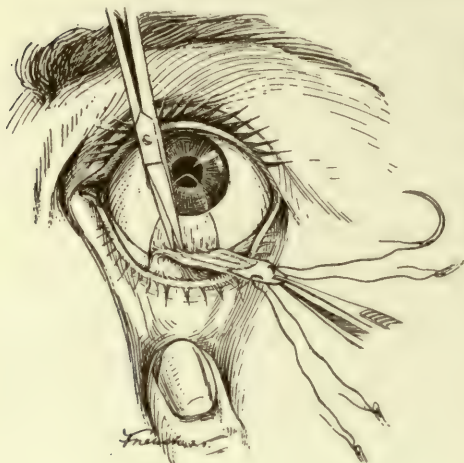


Fig. 2

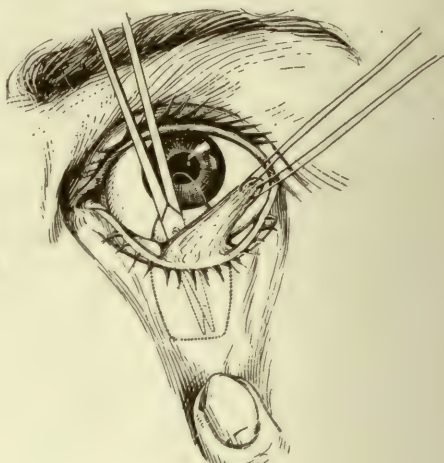


Fig. 3

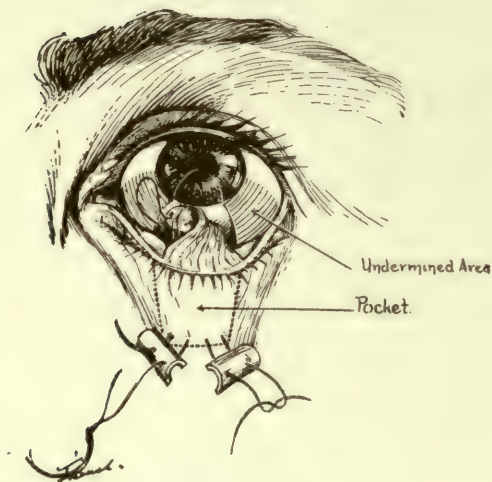


Fig. 4

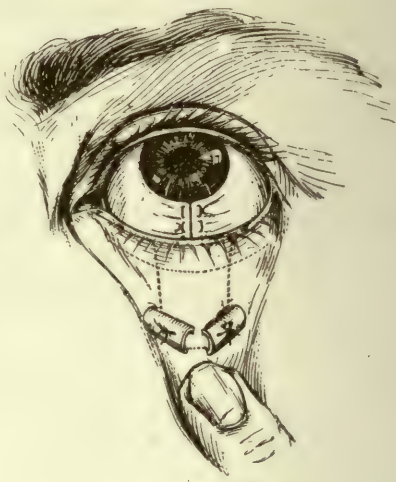


Fig. 5

2. The under surface of the tongue so formed is thinned by the removal of unnecessary tissue. Double armed sutures are placed in the tip of the pterygium, and the flap is tucked into the depth of the pocket formed. The needles are brought out on the skin surface and tied over sections of small rubber tubing (Fig. 4).

3. The conjunctivae on either side of the denuded bulbar surface are undermined, and brought together by mattress

silk sutures. (Fig. 5). The suture next to the fornix includes episcleral tissue to insure anchorage.

1. The pterygium is dissected from the cornea and globe as described above.

2. A pocket is fashioned under each lid as described above.



TYPE B. (involving canthus and lids). Fig. 6.

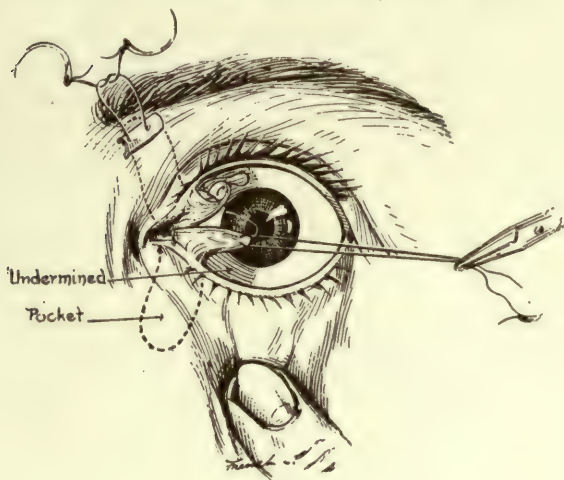


Fig. 7

3. The tongue, having been freed from the adventitious tissue is divided in its long axis, down to the base. (Fig. 7.) The upper portion is tucked into the pocket formed in the upper lid, and becomes a partial lining to the lid. The lower portion is similarly transplanted downward into the pocket made below, covering a similar defect in the lining of the lower lid. (Fig. 8.)

4. The denuded bulbar surface is covered by conjunctival flaps in the manner described. (Fig. 8.) The corneal site of the pterygium is curretted in the usual way, atropin instilled



Fig. 8

and some ointment, like White's, placed in the conjunctival sac. Both eyes are covered for a few days. The sutures may be removed after the fourth day.

#### DISCUSSION.

DR. W. L. BENEDICT, Rochester, Minn.: The difficulty of restoring the lids is an experience we have all had, and the number of operations and treatments that have been designed for this purpose are legion. The operation described in 1854 by von Arlt have done good service ever since. The second method of von Arlt consisted in removing the symblepharon or pterygium from the cornea, and drawing this down to form a lining for the tarsal surface of the lids. It is said that he also suggested the bringing together of the conjunctiva over the denuded bulbar surface, but I do not find that point mentioned in his original article describing the operation. In dealing with small growths that do not involve the whole surface of the lower lid, or the lower segment of the globe, this method serves very well, but does not give sufficient tissue to line the lower lid or to cover the denuded lower segment of the globe, if there has been a complete or total lower symblepharon. In dealing with the latter type of injury, Thiersch grafts will do very well. In case either canthus is involved and not enough conjunctiva can be secured to cover the exposed portion of the globe, I think the method of using paraffin covered lead plates, mentioned by Dr. Stauffer, serves better than dental compound. The lead plate can be made horseshoe shaped, taking up little space by its thickness, and will retain the desired form, leaving a proper depth to the cul de sac at the canthus.

DR. C. E. WALKER, Denver: On the first operation I do not think that any improvement could be made. But the second, the splitting of the pterygium in two parts as described by Knapp in his surgical work, (*System of Diseases of the Eye—Norris & Oliver Vol. III*), I think possibly could be improved. After removing the pterygium from

the cornea, snip off the apex, push the body of pterygium quite far back, undermine and cut the conjunctiva above and below, and in placing the sutures, the first suture goes through the conjunctiva, pterygium, and conjunctiva; second in conjunctiva; if a third is required it is placed in the conjunctiva only. In this way the pterygium can not advance, because you have this barrier between the cornea and the portion of the pterygium which was on the cornea.

DR. MEYER WIENER, St. Louis, Mo.: Two points I would like to bring out in this operation. First, in dissecting up the flap, I think it is very much better to include the superficial layer of the cornea with the flap. Thus you get less scar. I maintain that if the cornea is dissected out carefully and you remain in the same layer in which you start, you get no scar. It is better than curretting the cornea afterwards. There are certain cases in which you will not get enough conjunctiva below to bring over on the flap, and it will be necessary to use grafts. I believe that the Thiersch graft is about the only thing that will prevent it returning in a certain number of cases. Place it up to your corneal margin, covering the sclera. If it makes a white shining mass, it can be removed later without risk of return of the pterygium.

DR. C. E. WALKER, I wish to make a correction to a statement that I put the Thiersch grafts in. I do not. The pterygium is removed from the cornea (illustrates). I pick it up with a pair of forceps, pass the Graefe knife through the base of the pterygium, and remove a little portion of the tip with the scissors. Then I push the pterygium back, then pass the scissors above and below, cut the conjunctiva slightly diverging from the cornea. Do not follow the cornea in other words. That leaves the flap, above and below (illustrates). In placing the sutures, first suture through conjunctiva, pterygium, and conjunctiva; second only in conjunctiva. Now if there should be a little space when these flaps are brought together, then an extra suture will be required (illustrates).

DR. ROBERT SCOTT LAMB, Washington, D. C.: We do not always get a fine, triangular shaped traumatic pterygium. Sometimes there is marked adhesions to the lid. In such cases my practice is to get the corneal section clear and free and then undermine beneath the conjunctiva. I do not like to carry the Thiersch grafts. You split your pterygium down the center, and then get the lower end at the base and the upper at the top, and carry the two pieces in that direction, using the lower and the upper if necessary, turning the upper in such way as to cover the lid. Then you have no two raw surfaces together. You will be able to get perfectly good union and cosmetic result.

DR. C. W. HAWLEY, Chicago: I want to call your attention to a case where the immediate result may frighten you. Instead of cutting up the conjunctiva, I dissect up the conjunctiva above and below around the cornea to past the median line then sew the edges so as to cover the sclera.

In doing so you will cause the conjunctiva to fold over the cornea as I did in one case, almost covering it. This need not trouble you as by the next morning it will have contracted to its normal position. This will not leave freshly cut conjunctiva at the edge of the corneal wound.

# AN EXAMINATION OF THE EYE MAGNETS IN MOST COMMON USE, WITH A DESCRIPTION OF NEW MODELS FOR USE WITH DRY CELLS.

WALTER B. LANCASTER, M.D.

BOSTON, MASS.

For measuring the power of eye magnets I use two testers, previously described (Trans. Oph. Sect. A.M.A. 1914). Each has a steel ball at the end of a brass spring, which is gradually stretched until it pulls the ball away from the magnet. One has a ball about 1 1/2 millimeters in diameter, weighing .016 gram, and is used for measuring the pull in contact with the magnet tip. The other has a ball weighing .160 gram and a weaker spring, for measuring the much feebler pull at a distance from the tip. It is obviously better to measure an eye magnet by its power to pull small fragments at the range likely to be met in practical use, rather than by either large masses of iron in contact with the magnet, or by small objects at long distances, say 30 to 100 millimeters.

Table 1 shows the performance of different hand magnets tested in contact with the test object, and at 2 mm. distance. Small difference are of no significance.

Table 2 shows the performance of several large magnets tested at 10 and 15 mm. The pull in contact is of no consequence in large magnets, which are designed to pull at a distance. The distinction between magnets for use at close range and those for use at a distance is very important, and must not be lost sight of in criticising eye magnets.

Table 3 is an attempt, based on Hertel's experiments (Klin. Monatsbl. f Aug. 1919), to show the pull required to extract a splinter in the various positions in the eye in which it may be found.

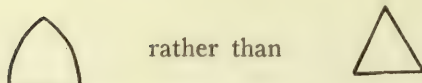
These findings have not much significance until they have been analysed and interpreted in the light of the various factors involved in the use of the eye magnets.

*1st. Size or weight of the magnet:* The hand magnets range from less than a quarter of a kilogram to over 3 kilograms. The difference in power between the smallest and the largest sizes is less than 25 percent, though the difference in

weight is about 1500 percent. It is evident that mere size does not necessarily give greater power in magnets to be used at close range. In fact, the smallest size could be so designed as to show greater power than it has, if the shape of the tips was chosen for the best showing with the tester, instead of for actual operative efficiency.

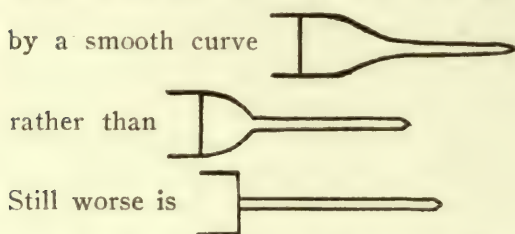
*2nd. Size and shape of pole pieces or tips:* The tip which will give the maximum pull on a tiny fragment in contact is conoidal, with a point slightly smaller than the end of the fragment; and the shorter the distance from the end of the coil to end of the tip, the greater the power. In practice, other considerations lead the designer to sacrifice somewhat in power for other advantages. In a large hand magnet, if the end of the tip is very near the end of the coil, you cannot see well, because the large diameter of the coil hides the operative field; hence the long space from coil to tip in most large hand magnets, with consequent loss of power. In a small hand magnet the diameter of the coil is so small—hardly larger perhaps than the diameter of the core in a large hand magnet—that the view is unobstructed, and there is no need of a long space from the end of the coil to the end of the tip. This is one of the chief reasons why a small hand magnet may be as strong as a large one, provided they are both tested with the fragment in contact. The second reason is that the end of the tip is less likely to be very blunt in a small magnet. This is because the large magnet aims to show some power at a distance. This is its only justification for its large size. Now power at a distance is increased by rounding off the point of the pole piece, and making it blunter. The obvious thing to do is to have two kinds of tips, or else two kinds of magnets; one for pulling in contact, the other for pulling at a distance.

The best form for a probe pointed pole piece is not a cylindrical rod uniform in size for an inch or more of its length, as in the Sweet and Parker models, still less a bulbous shaped tip, as in the Meyrowitz-Johnson model. The great general principle applying to all pole pieces for eye magnets is to keep as much iron as possible. For example, in the short conoidal tip, the simple cone or cone with the point rounded off, as in all European and most American models, is less powerful than the hyperboloid or bullet shaped, Gothic arch shaped tip,



Hertel recently reported (1919 Klin. Monatsbl.) some investigations as to the best shape for this type of pole. He repeated the experiments which I made twenty years ago, starting with an elongated cone, and reducing its length step by step. He found, as I did, that the shorter the cone, the greater the pull at a distance; but he did not hit upon the idea of still further increasing the power by changing from a cone to an arch shape, although he found that rounding off the apex of the cone increased the power at a distance. I do not recall who first suggested to me the hyperboloid shape. I think it was Prof. Louis Derr in whose laboratory I made my study of magnets in 1899-1900.

In the case of the probe point, the same principle leads us to make the cylindrical part taper slightly, and join the base



In the Parker model by Lentz, the tip is made with a base larger than the end of the core to which it is to be attached. This causes loss of strength. In the Hardy model, the base of the pole piece is smaller than the end of the cone. This too is an easily avoidable fault. There should be a smooth, continuous curve from the core to the end of the tip, with no angular break.

The longer the pole piece, the weaker it becomes. This reaches its maximum in the flexible polar extension, about an inch or less in diameter, and over a foot long. This was measured, and the pull at the end of a rather large magnet (the device is not for small magnets) without the polar extension, was 1400, and with the polar extension, 60; that is, the magnet was over twenty times as strong without the extension. In a similar way, the pull, when scissors or forceps or other steel instruments are made use of as polar extensions to transmit the magnetism to a distance, is a small fraction of the pull with a well designed pole piece. This is another

argument in favor of the smallest sized hand magnet, since it is not only far and away stronger than any of these polar extensions, but much more easy to manipulate with precision and delicacy.

Parker devised the concave end for the tip as a means of avoiding the not uncommon mischance of having the foreign body brushed off of the end of the tip when it is withdrawn from a small incision, into which it was introduced to reach a fragment inside the eye. It is not always easy to hold the lips of the wound apart. The objections to the Parker device are—1st, that the increased area of the tip reduces its pull, which is exerted all around the edge of the cup instead of being concentrated at one point:—2d, that the fragment will not under any conditions be drawn into the cup out of the way of the lips of the wound, but will always adhere, if at all, to some part of the rim. Therefore, Crampton's plan is far superior; namely, to surround the tip with a thin nonmagnetic jacket, preferably of silver, as nonrusting, projecting a little beyond the point of the tip. Thus the tip is at the bottom of a cup, and now the fragment is no longer drawn to the rim of the cup, but to the protected bottom of the cup.

Another device for avoiding the brushing off of the fragment by the lips of the wound, is to use a flattened pole piece instead of a cylindrical one. When this is to be introduced, it is made to enter the wound flatwise. After it has attracted the fragment and is to be withdrawn, it is turned crosswise, to hold the lips of the wound apart as it comes out.

#### MISCELLANEOUS CRITICISMS.

Most of the magnets are more bulky than is necessary, because there is much waste space inside the covering. This is a fault, because it makes the magnet a less easily manipulated instrument. Compactness is much to be desired. This is attained by covering the coil with a single layer of cord rather than with a metal core, which does not fit closely, and, moreover, is hotter to touch, and heavier. Considerable space is occupied in the end of the Parker magnet by the switch. In my opinion, a foot switch is much better than a hand switch. Most magnets lose in power by having too long a space from the end of the coil to the end of the core, where the pole pieces are to be applied. A common fault is too deep a hole in the end of the core for the screw which holds the pole piece. Any air space is a loss. The screw should be rather

small, and the hole no deeper than necessary. The large space which has to be hollowed out in the Parker magnet for the French joint instead of a screw, is an easily avoidable loss.

To sum up the analysis of hand magnet performance: Small hand magnets of less than a kilogram are just as powerful as those weighing three or four times as much, when used to pull fragments in contact, or less than 2 millimeters from the tip.

Small magnets are very much more easily handled for delicate manipulation, in the anterior chamber, for example.

The most useful tips are the conoidal for action at a distance; and the various lengths of probe points for dealing with fragments which have to be reached for. These should not be made longer than necessary, since the power diminishes rapidly with the length, and they should taper smoothly from the edge of the core to the end of the tip.

#### GIANT MAGNETS.

Hertel reports extensive investigations into ways of increasing the power of these magnets. He finds, as I did, that increasing the current increases the power very much. He did not ascertain, either from his own experiments or from a study of the literature, what are the underlying principles which govern the wiring and current supply. These were long ago set forth by Clark Maxwell. With a given voltage, say 110 or 220, or any constant voltage, the larger the wire, the more powerful the magnet. The limit is set by the wiring to the operating room. Most buildings do not admit of more than 20 to 50 amperes. Again, with a given voltage, the fewer the layers in the coil, the stronger the magnet. The limit again is the wiring of the operating room. One must use a wire of such size and length that the resistance will keep the current down to safe limits.

The core should be as large as can be conveniently handled, with suitable mounting. Its length, 10 to 12 times the diameter. The wire should be wound along the entire length of the core in as few layers of as large wire as possible.

The Haab is a very poorly designed model, and in the giant size is only of about the same power as my portable, large arm magnet. In Germany the Schumann model is used for a large, powerful type. This is virtually the same as my large type; and doubtless many independently have produced

about the same model. Schlosser's is much the same, except smaller. Volkmann's is good, except that the long polar extension is illadvised. The Mellinger ring magnet is not a good type. The style, which acts as the core and pole piece combined, is attracted by the coil, and when the current is turned on, the style is forcibly jerked toward the centre of the coil. This is disconcerting, and may do serious harm. Those who praise it for its ease of manipulation have never had an opportunity to try a good small hand magnet. For action at a distance, the ring magnet is far surpassed by a good large giant magnet of the usual type.

A recent improvement in managing the current for the giant magnets, is the remote control switch. The foot switch controls a magnet which closes the main switch placed at a distance. Only a small amount of current passes through the foot switch, which is therefore quiet and makes no flash. The main current goes through the remote switch, where it is out of the way.

The best way to mount the giant magnets, is by suspension from the ceiling or from an arm extending out from the wall, or from a movable frame which can be wheeled where wanted, and is wide enough so that the operating table or bed may go under it. The mounting which Haab recommends is not suitable for other cases, but otherwise is satisfactory. Since deep injection of procain and adrenalin will give satisfactory anesthesia, narcosis is rarely needed; and so the Haab stand does fairly well, if suspension is not available.

The latest improvement in magnets which has come to the writer's attention is the use of ferrocobalt for pole pieces. It has been shown that this alloy gives greater power when high degrees of saturation are used than can be obtained with iron under the same conditions. About 10% gain may be expected. Hertel tried this material and found gains of 17% and even more.

Inquiries are frequent as to the best thing to do when only alternating current is available in the operating room or office.

(1) One can use the alternating current to drive a *motor generator*. This is a rather large and expensive apparatus, but very reliable.

(2) There are on the market a number of different kinds of *rectifiers*. These give a direct current, but are said to get out of order.

(3) One can use *dry cells* or *storage batteries*.

(4) The Durkee magnet, recently placed on the market, claims to give as good practical results with indirect current as any direct current magnet of corresponding size gives with the direct current.

By the courtesy of the makers, two of these Durkee magnets were tested with 110 volt alternating current. (See table.) The pull in contact was 155 at one test, 108 at the other. A direct current magnet of this size (2 kilos) should pull ten times as much. The pull at 2 m.m. was too small to measure with the tester. Of course the magnet was not placed on the market with these claims without some basis for them. It was found on inquiry that by the tests used, the performance of this magnet was found by the makers to be equal to that of the Johnson. This test consisted in measuring the distance at which the magnet would just hold a small eyeglass screw from falling by its own weight. Several writers have used this test as a measurement of the power of eye magnets. It hardly needs extended argument to prove that the way to test small eye magnets for action in contact or very short range is by their power to pull a small test object when in contact or at short range, not at 5-10 m.m., still less at 50-100 m.m.

The mechanic who has made most of my eye magnets supplied, six years ago, to two customers, magnets for use with alternating current made on the same principle as the Durkee (laminated core to reduce hysteresis). By my advice he made no more. Recently he wrote asking these customers how the magnets worked, and received a reply from one, who said his was still working satisfactorily. The other letter was returned undelivered.

I tested the Durkee with a single Columbia dry cell, and found that the pull was stronger than with 110 volt alternating current. The trouble is that the alternating current reverses the poles of the magnet every time the current is reversed, 60 times a second, with 60 cycle alternating current. When the poles are reversed attraction and repulsion are reversed. For it must be borne in mind that a magnet pole not only attracts but repels and with equal force. The north pole of a magnet attracts the south pole of a splinter and repels the north pole. The attraction depends on the intensity of the magnetic field; so does the repulsion. If the fields are of equal intensity at both poles of the splinter, it is

not drawn toward the magnet at all, but only turned parallel to the lines of force. As one end or pole of the splinter is farther away from the magnet than the other and is in a weaker field, one pole is attracted more than the other is repelled and so the fragment moves towards the magnet.

Eye magnets were first used only with wet batteries, not dry cells, because dry cells were not then available. Now that dry cells are so easily obtainable and so efficient, there is no reason why they should not be used when better sources are not available. One can either buy the dry cells singly and put them together in any available box, or one can buy them all combined in a box, in sets of 6 or more, as supplied for ignition of gas engines. Each dry cell gives about  $1\frac{1}{3}$  to  $1\frac{1}{2}$  volts, so that by combining a dozen one gets 16 to 18 volts, and this will suffice for a small hand magnet with resistance of, say, one ohm.

Storage batteries are very easily obtainable, and are a reliable source of current of adequate strength. They are rather heavy to handle, but that is not an insuperable objection. Another advantage is that they can be hired for use as required, whereas dry cells have to be purchased and soon deteriorate.

Ordinary eye magnets can be used with dry cells or storage batteries, but as they are designed for much higher voltage, they are made with small wire of high resistance, hence do not give as good results as would be obtained with suitably chosen wire of low resistance.

One can buy dry cells in knocked down form, (Burn Boston Batteries). These will keep indefinitely in any climate until they are put together for use. Then they deteriorate about like any other dry cell. If one were located far from a source of supply, it might be a way of providing for emergencies to keep some of these Burn Boston Batteries on hand. They are easily set up in a very few minutes, ready for use.

#### SUMMARY.

Most of the hand magnets on the market have certain virtues in common, and certain defects. They are now made with fairly strong coils, which will heat up if left too long with the current on. A magnet which will heat up is not using as much current as it might, if properly designed for eye operations.

The hand magnets are mostly too large for delicate manip-

ulation. They gain nothing in power of pull in contact by their size, and for pull at a distance it is better to have another really large magnet.

TABLE 1

Name of Magnet	Weight	Pull in contact	Pull at 2 mm.	
Sweet by Geiger	3¾	1736 775	18.6 3.4	Short tip Long, probe tip
Hardy	3	1400 1270	6.8 6.8	Long, not slender Long, bent, not slender
Parker by Lentz	3¾	1550 310 220	18.6 *s s	Short Long, probe Long, bent probe
Johnson by Meyrowitz	2	837 527	5. 2.	20 mm. bulbous 30 mm. flat tip
Durkee by Meyrowitz	2	155 to 108	s	Long, pyramidal
Hand magnet at Manhattan	..	372	....	.....
Lancaster by Gleeson	1.6	1425 1116 930	12.4 .... 4.6	Short Probe Probe bent
Lancaster by Gleeson	0.5	1550 1395 715	.... .... ....	Short, conical Short, probe Probe, long, bent
Lancaster by Ziegler	0.2	1400 500	16 6	Short Probe, long
Lancaster by Gleeson Dry Cell Battery		1500 900 900	7.75 3.1 3.	Short, conical Probe Probe, bent

\*s—Too small to measure.

TABLE 2

Name of Magnet	Weight	Pull at		
		10 mm.	15 mm.	
Haab at N. Y. E. & E. Meyrowitz	80	12.6	5.5	Conical tip
Haab at Manhattan	80	11.	4.5	Conical tip
Giant at Wills Eye Hospital	60	4.6	2.1	Conical tip
Modified Haab	..	4.6	2.1	Round tip
Lancaster Giant by Clark and Mills	100	34. 18.	15. 9.	Bullet shaped tip Long, cylinder tip
Lancaster Large arm by Gleeson	24	12.	....	Bullet shaped tip
Schumann, estimated from Hertel	80	18.	8.3	Conical tip

There is too often a loss of efficiency by having the core project too far from the coil before the pole piece begins.

Very important is the lack, in most magnets, of a smooth blending of pole piece with core, without angles or sudden changes in diameter.

The slender part of the pole piece is needlessly long in many models. Some have no tip small enough to introduce through a small incision.

The Durkee Magnet, by repeated careful tests, failed signally to meet the claim made for it that it would pull "as much as any direct current magnet of equal size." It pulled only 1/10 as much as a good direct current magnet of smaller size. In fact it was more powerful with a single dry cell (giving of course direct current) than with the 110 v. alternating current for which it was designed, as striking evidence as could be desired of the unsuitability of alternating current for eye magnets.

The large or giant magnets do not make so good a showing as the hand magnets. Most of the large magnets are of the Haab model, and this is a particularly poor model. The core is too short, the coil is far too thick and bulky. A magnet of the same weight can easily be made twice as strong.

Is there any need of it? Reference to table III will show that even the strongest giant magnet has no power to spare when it is to be used to extract a fragment imbedded in exudate. The operator who has the more powerful and more manageable giant magnet, and who understands its action well enough to run it skillfully, will have a smaller percentage of cases where he fails to extract.

TABLE 3

Rough estimate of pull required to extract a splinter of iron given in terms of its own weight.

Varies enormously with shape and size and roughness of fragment, and with density and toughness of tissue.

In Aqueous .....	Slightly over	1
Vitreous .....	Slightly over	1
Blood Clot .....	Up to	100
Fresh exudate .....	Up to	200
Lens .....	100—	500
Iris and Ciliary.....	500—	1500
Organized exudate .....	1000—	3000
Sclera .....	3000—	30000

These figures are based on Hertel's measurements (Klin. Monatsbl. f. Aug., 1919) made on enucleated eyes in which actual splinters of iron had been found. Tiny clamps were attached, and the pull which would extract the splinter measured.

## DISCUSSION.

DR. LEE MASTEN FRANCIS, Buffalo, N. Y.: As is usual with Dr. Lancaster's papers, he has nowhere left any entering wedge for a technical criticism. I have no technical knowledge to give. Ease of management is of as great importance in a magnet as is magnetic power. One does not need these larger ones, provided he has access to a giant magnet.

I believe a foot stop is too slow of action in a case of iris prolapse. I wish Dr. Lancaster would investigate and turn his attention to a readily and rapidly worked switch.

The chief difficulty has been the method of mounting. The usual arm is too bulky to permit of ready approach by the patient and operation by the holder. Manageability of the instrument is almost of equal importance to the power. After a rather expensive and thoroughly unsatisfactory experience, I now use a small, compact motor generator unit, light enough to be carried anywhere. Designers and makers can supply this in the newer and better makes.

DR. JAS. M. PATTON, Omaha, Nebr.: I do not want to say anything about the technical side of the subject, but I do want to testify to the flexibility and power of the so-called arm magnet which Dr. Lancaster has designed. I have used it for some three years and it has given perfect satisfaction. It certainly has the qualities he described and is so arranged that the operator has access to the patient's eye in the manner Dr. Francis has spoken of. Dr. Lancaster spoke of approaching the foreign body from various angles. My colleague, Dr. H. Gifford, a few years ago, found that by throwing the current off and on quickly for a few times, he was able to dislodge foreign bodies that were otherwise irresponsive to the magnet, and has been able to deliver them by that means. We call this "jerking" the foreign body. This is merely a suggestion but it has been useful in our experience.

DR. ALLEN GREENWOOD, Boston: It is needless to say that in preparation for the care of the soldier boys in France, we would do our best to get a type of magnet that would be efficient and movable, and those of us in Washington who had this in charge, in looking around at the various magnets, appreciated the fact that the Haab magnet was too cumbersome and a small hand magnet not strong enough. We finally chose the two sizes devised by Dr. Lancaster, a small hand magnet with a tip to introduce into the vitreous chamber, and a large magnet weighing about 60 pounds, which could be suspended from the surgeon's shoulders by straps. In some cases the surgeons made a fixed or movable suspension apparatus. I can testify to their value myself, for I used both the large and the small in France, and I am sure we got all the pull that was necessary with the large one, and the small one was sufficient for the cases best adapted to it. I believe any one having them in the office will get everything that he needs. The large Lancaster was satisfactory everywhere it was used at the front. Unfortunately, we did not have all that we wanted, and had to send them around where they were most needed.

DR. C. E. WALKER, Denver, Colo.: I have had serious objection to the magnets because they could not be adjusted properly. Vetter's modification of the Haab magnet, sold by Meyrowitz, can be perfectly ad-

justed to the patient. I bought one but I had serious objection. It needed small magnet tips. I had a small hand magnet, but nothing is as good as the Lancaster, and the point of the Haab magnet was such that you could not enter the eye. Not really a point; they are too blunt. I had four more slender tips made, and these tips have been perfectly satisfactory. They can be screwed into place after the blunt tip has been removed. These answer every purpose, and I have not had any difficulty in removing the piece of steel with this form of magnet.

DR. EDWARD JACKSON, Denver: I wish to call attention to the enormous resistance to withdrawal from organized exudates, and from the sclera. The failure in old cases is due, not so much to the poor magnet and to poor manipulation, as to the resistance that has to be overcome. The foreign body sometimes cannot be started. In that connection I want to call attention to the method I have described, and which has not attracted the attention it deserves, of removing foreign bodies that have been in the eye for some time. The resistance is found to be a thousand times the weight of the foreign body.

A case in point was a foreign body that had been in the eye five months, and had been tried on three successive days, very prolonged trials, all that a strong young man could endure, with a magnet that was a modification of Haab's. It was wound from end to end. It gave severe pain each time it was applied to the eye, and the foreign body was not moved. After that I saw the case, and the foreign body was removed with a Sweet magnet by using scissors as an extension point, placing the termination of the core at the junction of the blades of the scissors. Then with the current on, a snipping motion was made. The attraction tends to draw the foreign body and the tissues around it between the points of the scissors, and in that way scissors cut to the iron and dislodge it. I have thus removed a piece of steel 18 months after entering the eye. I have attempted to bring them out with the point of a Graefe knife and forceps used as an extension to the magnet and have failed, but not with the scissors.

DR. LINN EMERSON, Orange, N. J.: The objection to most of the so called Haab magnets is, as Haab stated in a recent paper, that few are made according to Haab's directions. To be a Haab magnet two things must be present, a proper rheostat and a proper foot switch. Since I have had these, I have used no other form of magnet. Our offices are in an office building, and we have a 500 volt current for the elevator. I have had a Haab magnet specially wound for that current. It is so strong that if a tungsten lamp is brought nearer than one foot the filaments will be pulled off by the magnet and the light destroyed. The foot switch as supplied to me did not break quick enough. A 500-volt current gives a spark five or six inches in length and is not easy to break. I devised one like a jack in the box, about eighteen inches long with a very powerful spring, so that when I take my foot off the top it pulls up and quickly breaks the current. When scissors or strabismus hook are used on these magnets, with large blunt ends, they are pulled so forcibly that the end within the eye sometimes does damage and detachment of the retina follows. Within the past three months I have removed three foreign bodies, far back

in the globe, with an ordinary soft iron punctum dilator. The small rounded end of the punctum dilator is applied to the rounded tip of the Haab magnet, thus giving a large radius of movement of the point, and this punctum dilator going down to a needle point, you can put the point in a very small scleral incision and introduce it in the direction of the foreign body, first having ascertained its place by the X-ray. In three cases where failure to remove the foreign body by ordinary methods failed, I have succeeded in removing them on the tip of this dilator without great damage to the eye or detachment of the retina afterward.

DR. W. W. SWEET, Philadelphia: In 1902 I published a series of tests of the drawing power of magnets, comparing the small Hirschberg, the Haab, and the magnet I had designed. The tests were made with a delicate set of laboratory balances, with various sized pieces of iron and steel at different distances from the magnet tip, and the strength of the magnet measured in weights on one arm of the scales. The results showed the Haab magnet to be superior to the others in its drawing power on splinters situated 10 mm. or more from the magnet, and at 5 mm. it was still stronger as compared with the medium sized magnet, but the difference was small. At a distance of 2 mm. the medium sized magnet seemed to have the stronger attractive power.

While the discussion is not on the use of magnets, I think that the question of the relative drawing power of magnets is to some extent due to the saturation of the magnet, a subject to which Dr. Lancaster has referred in a previous communication. In the Jefferson Hospital in this city, we have both the 110 volt and the 220 volt current, and, although the magnet I use is wound for the weaker current, I often use it on the 220 volt current. For the short periods the current is on, there is no danger of overheating, and the stronger current insures full magnetization. The magnet I employ has the winding to the end of the core, and is much stronger than those of recent manufacture, in which a button to show when the current is passing occupies the space of some of the winding.

PROF. VAN DER HOEVE, Leiden, Holland: I should like to ask Dr. Lancaster if he tested the magnets only on the distal power, without interference of the tissue between the magnet and the foreign body; because in the eye, we always have ocular tissue between the foreign body and the magnet.

My predecessor in Leiden, Prof. Koster, tested for twenty years the Haab and other makes with a wire spring test, very much like Dr. Lancaster's apparatus.

When the small magnets were not strong enough, we used the giant magnet and brought the tip in the eyeball. This is difficult with the normal tip, and therefore we attached to the magnet steel pieces with a concave surface at one end and a convex surface at the other so that we got perfectly flexible ball joints. Though the magnet lacked power because of the lengthening of the tip, still we could prove that the power was stronger than from the usual hand magnet, and we succeeded in extracting foreign bodies which resisted the hand magnet.

DR. W. B. LANCASTER, Boston (closing discussion): I will answer the last question first. The pull of the magnet is virtually the same whether

you have ocular or any other nonmagnetic material between the magnet and the fragment; whether it exerts its pull through the sclera, or air, or blood, or water, or anything else that is nonmagnetic. But if you have magnetic metals, iron, cobalt, nickel, between the tip and the fragment, then you do not get the same pull; they intercept or divert the lines of force.

I should like to have some of you measured the effect obtained with a polar extension. There is one on the market made of a coil or spring, and therefore flexible. It is so made that you can put it on the hand magnet, or any magnet. Actual measurement shows that with this polar extension, the pull is about  $1/30$  as much as it is without it. Similar figures will be obtained with scissors, forceps, lacrimal probes, nails, or any other polar extensions used with the expectation of conducting the pull of the magnet from its pole to the end of a piece of iron placed in contact with the pole. So the pull with the polar extension, even when attached to a huge giant magnet, is a great deal less than it is with a small magnet the size of this, weighing less than a pound, and so very easily manipulated that it far excels any polar extension in handiness, as well as far excelling it in power.

One of the speakers said that when he had a strong magnet and tried to use the scissors as a polar extension, the magnet pulled the scissors out of his hand—obviously an unhandy instrument. If you have a small, easily managed magnet, you will do much better than with the extension on the end of a large one. Perhaps some of you would like to see that measured.

As to the foot switch, I think that the best arrangement is the remote control switch. This consists of a large switch capable of dealing with the large current used on a large magnet; but this switch can be put in any convenient place, preferably not too near the operating chair or table; it may be in another room, or down cellar, if you please, because it is not opened and closed directly by the operator, but indirectly through a small foot switch which operates the magnet which opens and closes the main switch. This eliminates the disconcerting flash and snap of the old style switch. The Sweet magnet has a foot switch, but it does not act positively. It may close the circuit, or it may not—simply imperfect construction. This illustrates one of our difficulties as designers. We cannot always make the instrument makers do as we would like them to.

Another objection to the large magnet is, that you cannot see what you are doing so well as with the small type.

The principle of jerking the foreign body, by opening and closing the current, is a good one.

With regard to the punctum dilator: if you tested that with this magnet tester, you would find that the difference would be a thousand or more likely ten thousand percent in favor of the small magnet, both as to power and as to handiness.

A little point about the shape of the magnet tip. Dr. Parker designed a magnet tip, the end of which is concave. That is, instead of being pointed, the tip is hollowed out at the end, forming a tiny cavity or cup. The idea is that you will in this way avoid the common accident of having the fragment brushed off the end of your magnet tip just as

you pull it through the lips of the wound. The expectation is that the fragment will be held safely in the hollow, and the projecting sides of the tip will keep the lips of the wound from scraping off the fragment. A few experiments with tips of different shapes, including square ended, or hollow ended, or flat ended, will show that the fragment is not drawn by the magnet to the centre of the tip, but to the edge; because the lines of force are most concentrated at the edge. With a cup shape tip, any small fragment will be drawn to the rim of the cup, not to the bottom of the cup. To remedy this fault, Crampton designed an ingenious tip. The iron tip is covered with a layer of silver, which is nonmagnetic. The tip has the usual conoidal point, but the silver coating is prolonged beyond the tip, forming a cylindric cup, with the point of the tip at the bottom of the cup. A small fragment is always drawn to the point at the bottom of the cup, not to the rim which is nonmagnetic. Thus it is protected from entanglement by the lips of the wound.

## A CASE OF SOCALLED SOLID EDEMA, LYMPHOMA.

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Solid edema, an ill defined term, has seldom been applied to an eyeball lesion, so there is very little in the literature in reference to the condition. The common understanding of the disease is a recurring swelling with redness. The example that we place before you is of an entirely different type,

Mrs. L. D. age fifty-two years, an American born housewife, first complained of trouble with her right eye in August 1919. A slight redness appeared on the inner side of the eyeball which increased in size. This injection appeared after a motor trip, when the eyeball pained badly and the patient felt ill for some days, with a little puffiness of the eyelids in the morning and some sensation of a foreign body in the eye. Most of her discomfort disappeared after the use of hot compresses, but the redness and swelling steadily increased. Through the kindness of Dr. A. W. Sylvester, I saw the patient on August 5, 1920.

The vision of the right eye was 20/40, cornea clear, pupil 4 mm., regular, active with no alteration in the color or consistency of iris. The media were clear, and the disc distinctly outlined without abnormality of pigment or vessel distribution. No change in the retina or choroid, so that the entire lesion was extraocular and occupied a position mainly to the nasal side of the globe. This pericorneal mass was 14 mm. wide and about 5 mm. thick. It was round, pink and edematous looking, and extended from a point about opposite the insertion of the superior rectus around the globe to the temporal side of the inferior rectus. The conjunctival vessels passed over the tumor without increased tortuosity and were only slightly enlarged in caliber, although more numerous and on pressure easily compressed. The tumor lay beneath the conjunctiva, was firm to pressure, immobile with a smooth margin which faded into the surrounding tissue, except at the limbus where the conjunctiva bulged to cover the mass.

The left eye: vision 20/70, pupil 4 mm., regular, active, media clear, disc without change, but in the macular region a lattice like irregularly rounded area one disc diameter in size, of pigment absorption and deposits.

When a child the patient had scarlet fever and measles and has always been susceptible to "cold"; once had an abscess of her eyelid, and once an abscess of her throat. At twenty she had a nervous breakdown, but since that time has had no recurrence. Has one living child and has lost none. She has had no injury or constitutional infection of any kind. She has never spent any long period in a tropical country, and has never had any intestinal upset or malaria.

To determine the nature of the mass, the patient was admitted to the Albany Hospital where the blood Wassermann, urine and stool were negative. Subcutaneous injec-

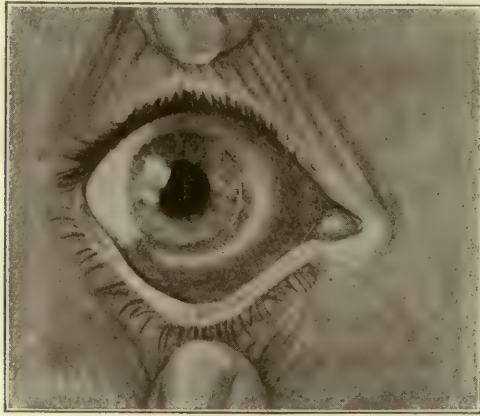


Fig. 1, Case 1. A Case of Solid Edema; Lymphoma. A rounded, elevated, peribulbar mass extending from limbus backward, fading into the surrounding tissue. The high light represents the definite edematous appearance of the growth.

tions of old tuberculin caused no local, general or focal reaction. Three teeth were found to have apical abscesses and were removed, and the patient given hexamethylenamin and increasing doses of potassium iodid.

After having been under observation four months, it seemed that there was a positive increase in the growth. On the 10th of December, under cocain anesthesia, the Shahan thermophore with the 5 mm. tip was placed over the superior margin of the mass, with a temperature of  $156^{\circ}$  for one minute. The application had no effect. Because of the smooth margin, taken in conjunction with the other findings, the patient was told that probably the mass was a firm edema. The growth was slightly larger, but there was the thought that it might

be malignant and, therefore, I hesitated for fear of making conditions worse, to take a piece for microscopic study.

On February 2, 1921, the patient was seen by Dr. George E. de Schweinitz who considered the condition one of the so-called solid edemas, and felt that the mass was probably not malignant. At this time all the perinasal sinuses were negative physically and by X-ray.

Some months later, May 7th, the patient again entered the

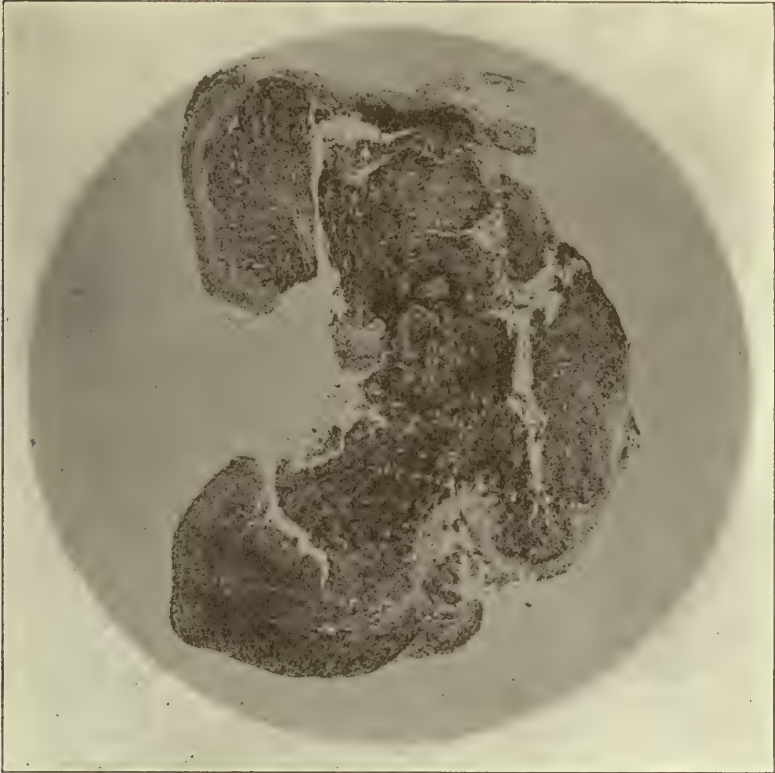


Fig. 2, Case 1. Superficial mass showing conjunctival surface and tumor. 62.5 X.

Albany Hospital, and a small piece of the tumor was removed, which Dr. Ellis Kellert reported as probably not malignant, a lymphoma. On the 25th of May, under ether, a conjunctival incision was made 3 mm. from the limbus, extending from above down to the inferior rectus. The conjunctiva was easily separated from the growth. At no place did the conjunctiva seem to enter into the mass. However, the tumor encircled

the internal rectus and inferior rectus, so that it was necessary to carefully dissect it from the two muscles. Although somewhat adherent to the sclera, it did not penetrate deeply. When removed, the tumor was soft and friable. There was very little bleeding, but the conjunctiva tore so easily that ordinary sutures would not hold, therefore, two traction sutures were placed across the cornea. The healing was uneventful. Conjunctival apposition excellent and the only point

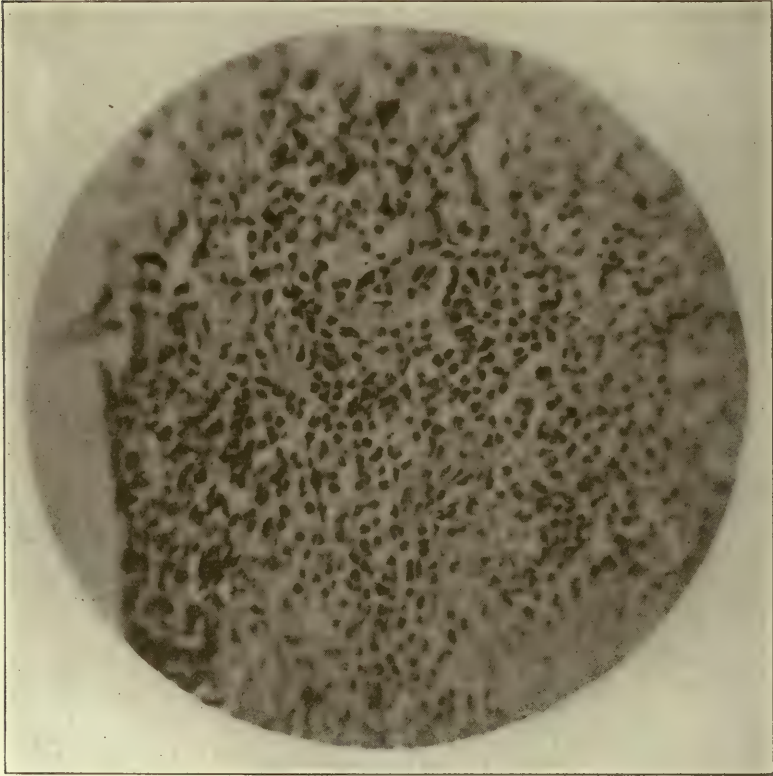


Fig. 3, Case 1. Nuclei large, oval, granular, eccentric. 600 X.

where vascularization persists is at the site of the preliminary tumor dissection.

The tumor mass proved to be a true lymphoma, consisting chiefly of lymphocytes and some connective tissue strands. The walls of the capillaries and blood vessels were intact.

Bacteriologically nothing had been developed. No organisms were found in the growth, and the parts implanted in rabbits and guinea pigs have failed to cause the death of

any of the animals, and now at the end of several months there is no evidence of tumor formation. The one guinea pig killed showed no evidence of tuberculosis.

It is well known that the follicles of the conjunctiva may proliferate in such a way that great masses of true lymphoid structure are found. As far as we know, there is no record of a mass growing on the eyeball of this size that has proved to be lymphomatous.



Fig. 4, Case 2. Showing enlarged masses on everted lids.

In comparison with the case just cited is that of Mr. G. B., age sixty years, who was first seen January 3, 1910, giving a history of irritation as of something in the left eye for two months, during which time there had been some lacrimation with slight secretion in the morning. The eyelids were decidedly thick with entropion of the lower lids as a result of

many large, firm, greyish pink masses. These swollen areas were tense, firm and round. In the upper cul de sacs, extending from the cartilaginous border, were masses the largest of which measured 3.5 mm. x 1 mm. These masses were removed and on examination proved to be lymphoma, which later, however, took on certain changes so that the diagnosis was made of lymphocytoma, lymphoblastoma, lymphosarcoma and malignant lymphoma.

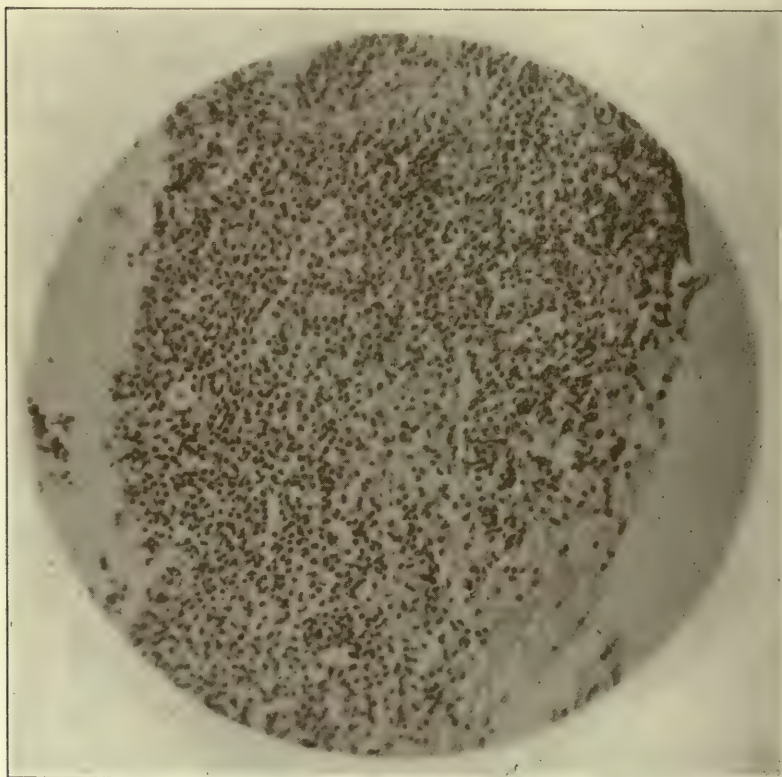


Fig. 5, Case 2. Nuclei deep staining, uniform in size and shape, rounded. 350 X.

Despite a very careful removal of all the diseased tissue, there were recurrences with extension first showing itself as a mass on his upper lip and extending from there to the glands of his neck and deep into the orbit, but extending in such a way that there was no proptosis, but an extension of growth back from the lids themselves. After being under observation four years, the patient went to bed August 20, 1914 and died September 21st of the same year, as a result

of edema of the lungs following laryngeal spasm. For months before his death it was with great difficulty that he spoke.

Histologically, the tissue was lymphoid in character with no suggestion of lymphoid follicles and germinal centers. The individual cells closely resembled the normal lymphocyte, and occasionally, similar but larger cells resembled lymphoblasts.

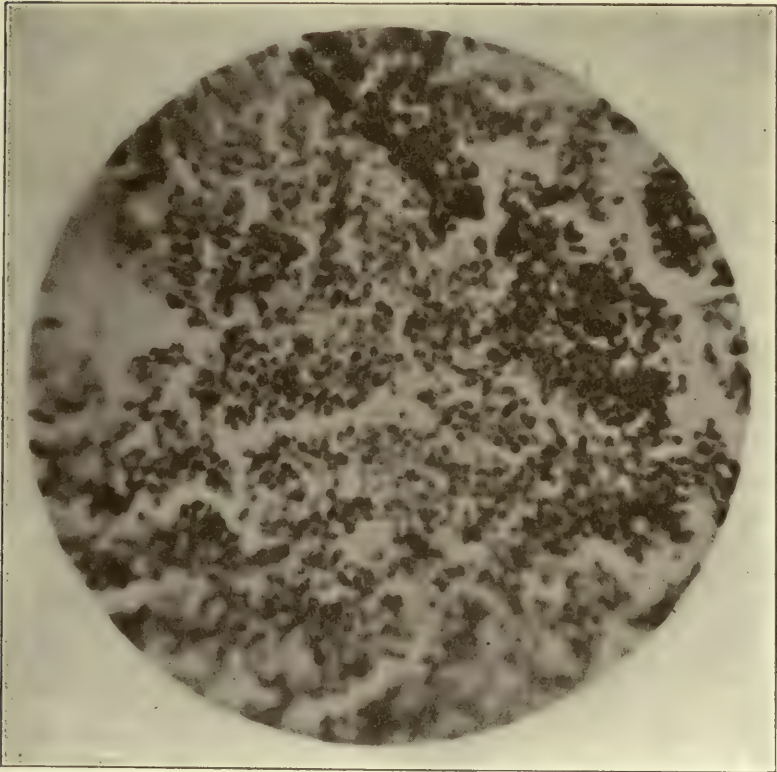


Fig. 6, Case 2. Nuclei deep staining, rounded. Some nuclei granular oval, showing cytoplasm. 600 X.

Mitotic figures were present but not numerous. The stroma was scanty, the blood vessels abundant and fairly well developed.\*

It is hoped by the careful consideration of these two cases others may record their observations and something new be gained.

\*Photomicrographs and sections were made under the direction of Dr. Anton S. Schneider.

## DISCUSSION.

DR. EDWARD JACKSON, Denver, Colo.: Perhaps I would better sit still and think about Dr. Bedell's case, which is different from anything I have ever seen, than to attempt to discuss it. But looking over his microphotographs and his picture of the case, it would seem that this is a form of new growth. The term "edema," is incorrect, and in so far as it suggests anything to our minds, will put us on the wrong track. Possibly such cases as have occurred have not been recognized and not been studied in the direction that would be most favorable.

The condition under consideration, a swelling that becomes malignant, suggests that this is a case in which a growth apparently benign, as is papilloma of the conjunctiva, in the course of years becomes malignant. The experience of the last few years points strongly to the idea that a malignant growth is nearly always an originally histologically benign condition that, for some reason, has gone wrong. Dr. Mitchell, a pathologist in Denver, of large experience, says a cancer is a state of "anarchy in the tissue." This is probably simply an increase of lymph tissue, peculiar in that the amount of the tissue is liable to become more and more altered until it can be classed as malignant.

The proper treatment for such tissues is to excise, at the earliest possible date, while it is still benign. The Roentgen ray and radium are efficient in so far as the tissue has deteriorated from the normal type, but with the knife, a tumor can be efficiently treated at any stage; and the specimens so obtained may not only increase our knowledge of the individual case, but increase our general knowledge of the class.

DR. GEO. F. SUKER, Chicago, Illinois: I wish to report two cases:

(1) Seven years ago, a woman, then aged about 40, presented in both upper and lower cul de sac of the right eye an oblong, yellowish white mass, apparently arising on the temporal side and advancing towards the nasal. The overlying conjunctiva was moderately adherent to each mass. The growths did not invade the bulbar subconjunctival space.

Under local anesthesia, these masses were carefully dissected out. The pathologist pronounced them lymphoma. I saw the patient again about a year ago, when a moderate return of the growth in both cul de sacs was noticed. These were again dissected out and the pathologist again reported lymphomata, with a suspicion of malignancy. X-ray and radium treatment were instituted and up to date no recurrence has appeared. The integrity of the globe was not involved.

(2) A rather perplexing case—a Greek with marked follicular trachoma, right eye, presented similar cul de sac growths as in case one. They were excised and reported to be lymphomata, with malignant characteristics. Up to date no recurrence has appeared. Patient received X-ray and radium treatment after the excision. The trachoma has no relation to the lymphomatous mass.

In both cases the masses had all the appearances of being an intense edema of a yellowish white color.

Dr. Bedell is right in advising surgical removal of these so-called tumors and subsequent treatment with either X-ray or radium.

DR. A. J. BEDELL, Albany, N. Y. (closing discussion): In the first case the X-ray was used for a long period, but as it had no effect, I operated.

## CONGENITAL ANTERIOR CAPSULAR CATARACT.

L. D. BROSE, M.D., F.A.C.S.

EVANSVILLE, IND.

The interest in this paper centers in that an entire family, consisting of five children, all developed in both eyes congenital anterior capsular cataract; again, that in three of the women we found corneal opacities, and that the capsular cataract in two of the women was followed later in life by total lens opacity with subsequent liquifaction of the lens fibers. Again, in case 2, after vision had been restored in childhood by an iridectomy made downward and inward, and remained good throughout school life and early womanhood, it was again lost for some six years, probably through lens displacement, then spontaneously restored, only to be again lost because of lens displacement into the iridectomy coloboma. And lastly, in the operative measures undertaken for sight restoration. The following is the case histories of this family:

CASE 1. A. V. B., aged 35 years, and a resident of Clay, Ky., consulted me May 7th, 1914. Father and mother living and have good eyesight. He is married, robust in appearance, and the father of a son ten years old with good sight. He has no recollection of ever having had a sore eye. The cornea shows no evidence of previous disease, and the pupils react to light. Occupying the central pupillary area, we found a circumscribed whitish opacity lying within the anterior lens capsule, but in front of the lens. Surmounting the opacity is seen a small spurlike elevation of clearer consistency and more grayish appearance. Vision O.D.=15/1xxx and Sn. D. 1.50; O.S. the counting of fingers at five feet. Ophthalmoscopic examination with plane mirror, after cocain mydriasis, disclosed the lenses transparent and the fundi healthy. A limited needling of the left lens was made with but slight reaction, and at the expiration of six days he left the hospital with instructions to continue the daily use of atropin. On July 20th, over half the lens substance has been absorbed, and he counted fingers at ten feet. A more extensive needling was made and the atropin continued, with an ultimate result of vision with +12.00=15/xl, and Sn. D. 0.65 with +16.00. The original capsular thickening remains, but is displaced upward under the upper pupillary border.

CASE 2. Mrs. N. G., a widow 45 years of age and resident of Boxville, Ky., consulted me December 25th, 1920. At the age of twelve she was operated upon in Atlanta, Ga., by the elder Dr. Calhoun, who made a double iridectomy downward and inward establishing vision in the right eye sufficient for the needs of her school life. Vision in the left eye was not so good. At the age of 25, sight again failed, and during the following six years she was unable to read, when spontaneously the sight returned and was preserved until September, 1920, when in two days, and associated with dazzling and vomiting, she became almost blind. I found old corneal opacities in both eyes; the iris very tremulous, that of the left also discolored. The right lens was wholly opaque, of a putty gray appearance, with a central circumscribed capsular thickening, from the base of which arose a small pyramidal outgrowth. The lens was displaced downwards and obstructed the iridectomy coloboma. Vision in the eye that of the counting of fingers directly in front of the eye. The left eye presented a dense whitish thickening of the entire anterior capsule, which appears united with the posterior capsule. Of the lens there remained only rests, and this directly beneath the original capsular thickening, upon which is preserved a pyramidal elevation. Vision in the eye is through a small space between the lower edge of the capsule and the periphery of the coloboma, and is limited to the counting of fingers at five to six feet. December 27th, an opening was made through the cornea below, and the fluid lens extracted within its capsule. Vision obtained 15/lxv with +11.00, and the reading of Sn. D. 0.75 with +16.00. The visual loss is largely due to an old preexisting corneal opacity.

CASE 3. Estelle B., unmarried and 35 years of age, consulted me December 13th, 1920. In each eye, above and below, there is an old corneal opacity. She denies ever having had a sore eye. The right lens is opaque throughout, with a more circumscribed and denser capsular thickening within the pupillary area, upon the base of which rests a small pyramidal spur. Vision is limited to hand movement at a few inches distance. The left eye shows an anterior capsular cataract with some involvement of the anterior lens fibers. Vision, the counting of fingers at twenty feet. The right lens was needled, and the degenerated flaky fluid lens evacuated into the anterior chamber. During the succeeding twelve hours decided reaction followed, accompanied by pain in the

eye, vomiting and increased intraocular tension to 44 mm. measured by the Gradle-Schiötz tonometer. Linear extraction was made which relieved the pain and tension, and at the expiration of six days she returned to her home. On May 13th, 1921, discission operation with a Ziegler knife, and the capsular opacity displaced upward back of the iris. A visual result of 15/1 with +10.00 sphere was obtained. June 10th she reported that the capsular cataract had dropped down into the pupillary area and obstructed her sight. June 21st, through a linear corneal incision made below, the capsular cataract after some effort was grasped with forceps and extracted, and sent to Dr. F. H. Verhoff of Boston for microscopic examination. He reported the following: "The specimen is a typical anterior polar cataract of the pyramidal type. Its base is 2 mm. in diameter and its apex is elevated about 1 mm. It consists essentially of a degenerated, laminated hyalin mass, completely surrounded by a capsule similar to that of a normal lens. The anterior central portion is almost entirely devoid of cells, although here and there necrotic nuclei may be seen. At the base a considerable number of elongated epithelial cells are present and also a few cell masses. There are here, also, large deposits of calcium salts. An occasional cell is found beneath the capsule covering the anterior surface of the cataract, and exactly at the apex there is a small group of epithelial cells which have formed a new capsule around them. These cells are thus in the act of forming another minute pyramidal cataract at the apex of the original one." An active iridocyclitis followed the capsule extraction with heavy vitreous opacities. By October 3rd absorption of these opacities had progressed to the extent that vision 15/1 is again obtained.

CASE 4. Joe B., aged 9 years, consulted me March 1, 1903. He presented in each eye a small, circumscribed, anterior pyramidal capsular cataract; outside of the capsular thickening, the lens is transparent. Ophthalmoscopic examination disclosed below the optic disc both eyes a small conus, otherwise no fundus lesion. Vision 15/1 and Sn. D. 0.50 each eye. November 7, 1920, again examined, the eyes presenting much the same appearance as eighteen years ago. Distance vision still 15/1 but near vision reduced to Sn. D. 1.00. May 2, 1921, again examined: vision O.D.=15/c and Sn. D. 1.50; O.S. 15/lxv and Sn. D. 1.25. With the ophthalmoscope it was seen that the underlying lens fibers, especially in the right eye,

were becoming more and more opaque. The right lens was rather freely needled and the patient permitted to return home on the fifth day. When last seen in July, absorption of the lens was slowly going on, but at least one other needle operation will be required.

CASE 5. Mrs. A. M., aged 43 years, residence Owensboro, Ky., was examined April 10th, 1919 and found to have anterior capsular cataract both eyes. She went through school life without difficulty, but during the past three years is aware of sight failure. Vision O.D.=the counting of fingers at 15 feet, improved to 15/c with  $+1.50 \text{ C} - 3.50 \text{ cyl. ax. } 120$ ; O.S., counts fingers at 15 feet. The eye is highly astigmatic with axis oblique, and not subject to sight improvement with lenses. Both cornea show old opacities, although she does not recall ever having had sore eyes.

The pathology of congenital anterior capsular cataract is still incomplete. We can accept as partial explanation a disturbance of development of the epithelial capsular lining, but the underlying cause for such disturbances is not clear. It certainly is not the result of misplaced embryonal cells, since no one has reported the finding of extraneous tissue formation within the capsule in these cases. Again it cannot be the result of bacterial invasion of the lens capsule, since this membrane remains unbroken over the opacity and pathology teaches that bacteria as a rule are incapable of penetrating an unbroken membrane. Treacher Collins<sup>1</sup> advances a tension theory in explanation for the early stage of capsular opacity. He believes that because of contact between the lens capsule and cornea, the underlying lens fibers undergo shrinkage and break up into hyalin globules and detritus because of disturbed osmosis. Due to this shrinkage, the tension of the capsule at the anterior pole of the eye is lessened, and thus the only obstacle to rapid proliferation of the capsular cells is removed. To me a more plausible explanation is that of invasion of the capsule by a soluble toxin, the result of an inflammation in some part of the anterior portion of the eye, maybe diseased cornea, iris or pupillary membrane. Three of my patients had corneal opacities in both eyes, evidence of previous eye disease. Nor does the fact that both eyes are similarly involved, not alone in one member but in others of the family, render this theory untenable. We all recognize that interstitial keratitis, the result of inherited syphilis, is prone to involve both eyes, and that it may appear

in more than one child. Whether the infection in anterior congenital capsular cataract is likewise of syphilitic origin, I have no evidence to offer. The development of the lens begins very early in fetal life, in its fourth week, and until the end of the third month the lens is in close relation with the anterior eye segment, so that disease in this part of the eye may readily affect the lens and its membrane. Again the pathologic histology of this affection according to O. Becker<sup>2</sup> is similar to that of acquired anterior capsular cataract, seen in early childhood after corneal ulceration. The primary response to the toxin is one of focal epithelial cellular proliferation within the capsule in the uncovered pupillary area, with the formation of a cloudy excrescence, maybe flat or surmounted by a small spurlike elevation. The capsule, be it remembered, is thinnest at the anterior pole of the lens, represented by the intrapupillary area, and readily bulges over an underlying coagulated exudate. Soon degenerative changes occur, especially in the cells directly beneath the protruding capsule; the cells develop large vesicles, lose their nuclei, break down and take part in the formation of a laminated hyalin excrescence, over which the capsular membrane continues unbroken. In the deeper portion of the excrescence, the cellular necrosis is not so complete and there one finds a stratified formation made up largely of spindle shaped cells while next to the lens, in older cataracts at least, a thin layer of normal epithelial cells may be preserved. These cells, according to Parsons<sup>3</sup> are capable of normal functional activity, as evidenced by the production of a new cuticular membrane directly overlying them, and limiting posteriorly the subcapsular excrescence. In old people, it is my experience that anterior capsular cataract may result after circumscribed central corneal perforation, the result of a serpiginous ulcer, but that early and complete lens opacity follows. The reported finding by Verhoeff of a small group of cells at the apex of the pyramidal opacity, that had formed another new capsule around them and were in the act of producing another minute pyramidal cataract, is not only unique but interesting. It is my belief that these cells came from original peripheral capsule cells, and were excited to proliferation through the reaction that followed the first needle operation, since Arlt<sup>4</sup> states he found no cells in the outer two-thirds of the opacity in a case of anterior capsular cataract examined by him. In addition to vesicular degeneration, we find molecular, fatty

and calcareous degeneration, and at times cholesterin formation, especially in the deeper and older portions of the excrescence. The lens fibers immediately underlying the capsular opacity sooner or later, in many cases, undergo cataractous degeneration with excavation.

OPERATIONS: It is preferable to do an iridectomy or a discission operation, and what should influence us in making a choice. Where vision is decidedly better after mydriasis, and it is reasonably certain that the capsular opacity will not be followed later in life by extensive lens opacity, the advantages of retained accomodation especially in the child should influence one to do an iridectomy. However, I know of no way of foretelling that the lens will not later in life become cataractous, and because of this, if an iridectomy is made, I should prefer to do it above rather than below. Of course the amount of vision we hope to establish should not be left out of consideration in determining the site. In adult life, where glasses must soon be resorted to for near work, I should prefer to do a discission operation. It is almost needless to add, in persons where the capsular cataract is small and interferes but little with sight, nothing should be done in the way of an operation.

#### BIBLIOGRAPHY.

1. Collins. Mayou's Pathology and Bacteriology, International System Ophthalmic Practice.
2. O. Becker. Graefe-Samish. Handbuch der gesammten Augenheilkunde.
3. Parsons' Pathology of the Eye, Vol. 2.
4. Arlt. Histologie des Auges.

#### DISCUSSION.

DR. E. B. HECKEL, Pittsburgh, Pa.: Typical anterior polar cataracts are interesting. There is no explanation I know of to offer as to the etiology of this condition. The reader of the paper has gone into the various things that might produce it, and I am satisfied to regard it as developmental. A peculiar thing is that we find them running through several generations. I have heard of only four generations, and it started with parents both of whom had normal eyes. Married and had five boys and six girls. All of the males had cataract. One married a woman with apparently perfect eyes. They had three children, two males and one female. One male married and had two children, both males, and both had cataract. This one married a woman whose eyes were practically normal. This man died at the age of 29 and had been able to get along without difficulty with his eyes. The cataract did not interfere. A brother 45 years old has an anterior polar cataract. They show by reflected light. This man has gone through college, studied medicine and is practicing medicine without apparent trouble. This is

pictured in No. 1. His sister married a man with normal eyes. Her cataract is pictured in No. 2. It is practically now all opaque, at 49 years of age. She married a man with normal eyes. They have two girls, both with cataract. The older one is pictured in No. 3, a small central cataract. She is now in a small college in this city. The sister has a general cataract of the whole lens, and is a student in high school and has not considered herself much handicapped up to the present time. In figures 1 and 3, even with pupils contracted, they have a good deal of vision. The practical point is what to do to relieve them when the lens becomes entirely opaque. If this is so large that it interferes when the pupil is contracted in the day time, the most practical thing to do is an iridectomy, providing the rest of the lens is clear. When the lens is generally opaque, the logical thing to do is to remove the lens, in capsule if it can be done, because it is in the capsular substance and not the lens. So that the logical thing would be to remove it in its capsule. Make a corneal section and then with the capsule forceps remove the lens and cataract *en masse*, with iridectomy or without.

DR. A. J. BEDELL, Albany, N. Y.: Only one point I wish to make, the question Dr. Brose asked himself was how to determine what operation to do. As soon as he uses the slit lamp, he will be able to tell the exact location of the opacity and determine the operation.

DR. L. D. BROSE, Evansville, Ind., (closing discussion): We sometimes hang a man on circumstantial evidence and then acquit him. If the eye shows no evidence of preexisting disease, we think we have an irregularity of development within the capsule. If it shows evidence of prenatal disease, we think this has caused the capsular cataract. Because the lens capsule is a cuticular structure, the product of the original capsular cells, these cells must have functioned normally prior to the development of pyramidal cataract, during which they undergo proliferation and degeneration. The capsule never shows involvement in these cases and I hold this as an evidence against the theory of irregular developmental anomaly as accounting for anterior pyramidal capsular cataract. I followed one of these patients 19 years, and was unable to note any changes in the eye during early life that led me to believe that lens opacity sufficient in extent to necessitate its removal would occur in later years.

## ENUCLEATION WITH IMPLANTATION IN CAPSULE OF TENON.

WALLACE RALSTON, M.D.

HOUSTON, TEX.

The enucleation of an eye at best is a somewhat unsatisfactory surgical procedure, especially from the patient's standpoint. The conditions which have lead up to the operation have been to him a great tragedy. He greatly feels the physical or cosmetic defect, is unduly sensitive and psychologically depressed for life. It, therefore, becomes our urgent duty to relieve him as much as possible by selecting an operation which will insure safety to life with preservation of vision in the fellow eye, and at the same time minimize his deformity.

The operation most nearly approaching the ideal is some form of implantation in Tenon's capsule. From a cosmetic standpoint, the prothesis should appear very like its fellow eye without a sinking of the upper lid, and with a good motility. Even after a perfect operation, good cosmetic results may be entirely destroyed by a poorly fitted prothesis.

Lange, in 1555, appears to have been the first to perform an enucleation or "extirpation" as it was then termed. Bartisch (of Königsbruck, Saxony) in 1583 was the first to describe a method of procedure. He passed a strong thread through the eye ball, with which he pulled the globe forward while all the attachments were crudely severed. As a consequence of its severity and the absence of anesthetics, there were very few extirpations, and these only in such cases as cancers, tumors, hematodes, etc.

In 1841 Ferrall and Bonnet, working independently, devised the operation of enucleation very much as done today. Little interest was manifested in this newer operation until Geo. Critchett, in 1855, advocated enucleation in staphyloma, intra-ocular foreign bodies, symblepharon, and in painful eyes in which sympathetic ophthalmia seemed probable. By this time chloroform had been introduced, thereby encouraging the development of surgical measures.

James Beer, in 1817, first performed evisceration. In 1884, Graefe and Mules advocated evisceration to lessen the danger of meningitis. Until recently this operation was used to some extent

instead of enucleation, but it has gradually given way in selected cases to some form of implantation in Tenon's capsule.

Adams Frost, in 1886, seems to have been the first to use implantation in Tenon's capsule. Lange improved the method by the inclusion of the capsule in the sutures. Implantations were rather rare until the beginning of the 20th century. About this time, various methods and substances were tried. Fat was used after Barraquer's suggestion in 1901. Today the implantation operation is practiced generally by the better ophthalmic operators. The substances used mostly are metal spheres, glass spheres, fat and paraffin balls.

The indications for enucleation, which usually means implantation also, are pretty well defined. It requires rare judgment, however, in some cases to determine whether the eye should be removed, and if so, whether an implantation is indicated. An eye should be enucleated:

- 1 When hopelessly injured.
2. When hopelessly blind, painful, unsightly, easily irritated, or showing signs of producing sympathetic ophthalmia.
3. When containing malignant growths.
4. When there is painful absolute glaucoma that will not yield to other treatment.
5. Where there is extensive abscess of the orbit in which other methods fail, or where it may become necessary to attack surgically the neighboring parts in order to save life.
6. Where there is panophthalmitis.

This last is a much mooted question and certainly before enucleation, one must consider the possibility of meningitis, sympathetic ophthalmia and thrombosis of the cavernous sinus as later complications. Sympathetic ophthalmia rarely occurs under one month after injury, most frequently in the fourth and fifth months. As months and years pass the probability of sympathetic ophthalmia decreases.

Indications for implantation within the capsule of Tenon include all cases of enucleation, except those in which there is a panophthalmitis, some active purulent process, or where it is desired to leave free drainage, or to have the deeper parts more easily accessible. The latter may be the case when radium or X-ray treatment is contemplated.

The results obtained by the implantation of the proper material over simple enucleation are the following: Motility of the

prothesis, flow of the natural secretions over the shell in the proper channels, lack of enophthalmos, and little or no sunken orbit. A very natural and life like appearing artificial eye is possible.

The method employed by us is as follows: The eye is enucleated in the usual manner, great care being exercised to preserve all tissue possible and not to disturb or injure Tenon's capsule. When inspected, the cavity from which the globe has just been removed, should give the appearance of a smooth, widely open sac. All hemorrhage must be completely stopped. The application of very hot, moist, gauze sponges usually is sufficient for this purpose, though occasionally hemostats may be necessary. In applying the hot sponges, care should be taken not to burn the lids or other tissues of the orbit, in which case necrosis and failure will result. If the optic nerve is severed at right angles severe hemorrhage is less likely to occur. Carotid compression may be necessary in a profuse hemorrhage or in hemophiliacs.

When all oozing is stopped, an 18 mm. gold sphere, or other substance to be used, is inserted in the now dry sac. A double naught (00) chromicized catgut suture is so placed as to catch the superior rectus with a fair amount of Tenon's capsule; this same needle is then inserted in like manner to embrace the inferior rectus with capsule, very little traction is exerted and the catgut tied. The ends are cut very short. In like manner the internal and external recti are sutured. The next step is to close Tenon's capsule proper with a purse string suture of 00 chrom. catgut. No traction should be made, though the knot itself is securely tied, and the ends cut very short. The conjunctiva is now closed with four or five interrupted silk sutures. A pressure bandage is applied for three days.

The implantation of a sphere is indicated also in those cases of sunken sockets where the enucleation had been performed at some previous date, perhaps many years before. This operation is more difficult to perform, with some possibility of the sphere not remaining exactly in its central position. This is due to the fact that there is no longer a sac or cavity in Tenon's capsule, and the muscles have retracted, with a considerable amount of scar tissue present.

The deferred implantation is done usually under local anesthesia, a few drops of holocain or cocain being instilled into the cul de sac, followed by injections of novocain and adrenalin solution. The deep injection of novocain elevates to some extent the

conjunctiva and subjacent tissues, thus giving an idea of the bands of adhesions. Unfortunately, nearly all of the scar tissue is in the very center, at the worst place for our work. At this point the tissues are actually drawn backward toward the optic nerve by cicatrices, causing a depression on the conjunctival surface.

The conjunctiva is opened by a vertical incision approximately two-thirds distance from the outer canthus to the center of the socket, and dissected in all directions from the underlying parts, from the external canthus to a point well beyond the center. The incision in the deeper structures of the orbit is made parallel to the conjunctival opening, as near the outer canthus as practicable, the conjunctiva being drawn well temporalward with a strabismus hook. A slowly executed stab wound is made with a sharp knife held at about  $15^{\circ}$  to the surface. The point of the knife is pushed approximately one cm. beyond, one cm. above and one cm. below the center, as marked by the scar tissue present. This wound should be made by one well-directed stab so as to avoid unnecessary traumatism. Into the fairly large cavity just created a 14 mm. gold sphere is inserted. Its resting place should be somewhat on the nasal side to allow for a slight shifting temporalward. The walls of the canal or tract through which the sphere has just been inserted are approximated by two or three catgut sutures. These sutures are deeply placed in order to securely close the canal; the ends cut short, and then covered by conjunctiva. The conjunctiva is closed in the usual manner with silk, completely covering the entire deeper field of operation.

It will be seen that the two incisions do not fall one over the other. It is very important that the deep line of incision is completely covered by smooth uninjured conjunctiva. A pressure bandage is applied for two or three days.

There is some danger of this sphere being pressed toward the line of operation. This can be obviated by making your cavity of sufficient size, and by the use of some form of support for a short time. In some cases, massage is necessary to maintain the globe in the proper position. The spheres used in these cases must be somewhat smaller than those used in the operation immediately following enucleation. It is advisable to wait at least three months or preferably six months after enucleation, where no sphere was implanted at the time of enucleation.

## BIBLIOGRAPHY.

- The American Encyclopedia of Ophthalmology.  
 C. H. May. Medical Record, May 29, 1886.  
 E. O. Belt. Journal of American Medical Ass'n, Nov. 7, 1896.  
 R. B. Carter. Lancet, July 31, 1897.  
 L. W. Fox. Journal of American Medical Ass'n, Jan. 8, 1898.  
 L. W. Fox. Journal of American Medical Ass'n, Jan. 18, 1902.  
 W. B. Weidler. N. Y. Medical Journal, Nov. 2, 1912.  
 Edw. Stieren. Journal of American Medical Ass'n, Aug. 15, 1914.  
 Allen Greenwood. Arch. Ophth., Vol. XLIII, 1914.  
 J. M. Wheeler. Am. Journal Surg., June, 1917.  
 W. M. Sweet. Arch. Ophth., Vol. XLVIII.  
 H. J. Howard. Arch. Ophth., Vol. XLVIII.  
 J. B. Stanford. Southern Medical Journal, Aug. 1921.

## DISCUSSION.

DR. ALLEN GREENWOOD, Boston: I am very glad Dr. Ralston has again called the attention of this Academy to an operation that has not been adopted to the extent which it seems that it deserves. When this Academy met in Chattanooga several years ago, I read a paper covering forty cases of implantation of a glass sphere. My plea was that any individual who was to have an eye removed should have the advantage of the best cosmetic result, and I am still convinced that any surgeon who does not do this is neglecting his duty to the patient. I felt very strongly about this when I went to serve with the British army in Flanders, and I carried a large number of glass balls and put in many for soldiers. When these soldiers had their artificial eyes fitted their people at home were unable to distinguish on ordinary inspection which eye was the artificial one.

I have urged the adoption of the operation of implantation for over twenty years. I think I was the first in this country to advocate the use of a sphere of sufficient size and I went too far in my enthusiasm, even to using a 24 mm. sphere. I now use a 20 mm. sphere usually, rarely an 18 and the patient when he wears an artificial eye sees no difference in the appearance of the two eyes, for the filling in of the socket removes any sulcus above the lids.

One or two points in this implantation operation I wish to call to your attention. After you have done your enucleation the glass globe or gold ball (I use the former because it is lighter and I have never seen one broken and I have put in considerably more than 100 in private practice and many for our soldiers) must be fastened in Tenon's capsule before you bring the muscles together. Otherwise it may be extruded. In our operative course at the Harvard Medical School, we have demonstrated on the cadaver that there is a very distinct capsule inside the cone of muscles. The ball slips into this sac which is sutured over it. The muscles are then brought over and sutured and the conjunctiva over all. The sutures in the conjunctiva should never be put in as a purse string, as sometimes advocated, as this shortens the palpebral fissure. Interrupted vertical sutures should be used.

After closing the lids, a good quantity of vaseline should be placed on the closed lids and a pressure bandage applied to remain two or three days. When the pressure bandage is taken off the eyelids are almost never swollen and no ecchymosis is seen. The artificial eye should be

put in about ten days or two weeks from the time of the original operation. If a pressure bandage is not used, you will be unable to insert the artificial eye for a longer time.

Let me once more make the plea, as I have so many times, not to let your patients go around the world with motionless staring artificial eyes.

A few years ago in New York Dr. Weeks read a paper on substitutes for enucleation and the speaker opened the discussion with Dr. de Schweinitz and Dr. Parker and all advocated the implantation operation as giving the best results.

DR. GEO. F. SUKER, Chicago, Illinois: In heartily endorsing the value of Dr. Ralston's paper and emphasizing the remarks made by Dr. Greenwood, I wish to say:

1. The best foreign material to implant into Tenon's capsule is a lead free glass ball. It is the only substance not affected by the body juices.

2. The implantation of fat, though practical, necessitates another operation. One must be careful not to crush the fat with forceps, as this will cause the graft to necrose very easily. Again, if it is not absorbed, it eventually shrinks so much that the final result is largely thwarted.

3. In all implantation it is absolutely essential that the implant be placed in Tenon's capsule, held in place by a purse string suture, over which the four recti muscles are to be sutured, and finally the conjunctiva. This is done to prevent the implant from roaming about in the socket, and to secure a good thick overlying cushion of tissue for the prothesis to rest upon.

4. Sympathetic ophthalmia following an implant into Tenon's capsule does not occur as the removal of the globe obviates it. If, however, sympathetic ophthalmia should follow, then the primary enucleation was unduly delayed, and is not a fault of the operation but one of judgment in not enucleating early enough.

I have been implanting into the capsule of Tenon for over twenty-five years, and never had any subsequent complications of any kind.

The glass ball is now and then extruded. This happens only in the first week, never after complete healing has taken place. This is due either to infection, or to the fact that too large a glass sphere was used, thereby causing undue tension upon the sutures.

Before implanting anything into the capsule cavity, all hemorrhage must be completely checked. And, in using an ordinary tonsil snare to remove the globe, after it has been freed in the usual manner, very little if any hemorrhage takes place—a so-called bloodless enucleation.

The first bandage must be a tight one to assist in avoiding marked edema and secondary hemorrhage. It is good practice to apply an ice bag over the bandage for the first ten or twelve hours after the operation. The subsequent bandages should also be very snugly applied.

The cosmetic result is far superior to the simple enucleation, and to avoid much drooping of the upper lid, care must be taken not to destroy the lenticular ganglion, the source of sympathetic nerve fibers supplying Müller's lid muscle.

DR. ALLEN GREENWOOD, Boston: After over twenty years experience, I have only seen two glass balls extruded after this operation, and these

where a large hemorrhage into the tissue had occurred behind the capsule of Tenon and the ball. So any criticism that glass balls will not usually stay in is not sound.

DR. LUTHER C. PETER, Philadelphia, Pa.: It is gratifying to hear Dr. Greenwood emphasize the points which are essential for the retaining of implanted balls. First, as to the size of the glass or gold balls. The small ones, from 12 to 14 mm. in diameter, will not produce good cosmetic results, although they are easily retained. On the other hand, a large sized ball produces excellent cosmetic results, but there is some danger of extrusion of the ball before the healing process is complete. Spheres 20 mm. in diameter have been the most satisfactory size in my hands.

Reference has been made to the insertion of the sutures. The capsule of Tenon should be sutured by a 00, 20 day, chromicized catgut. A purse string suture is the most satisfactory. The conjunctiva is closed separately by sutures placed vertically, leaving a horizontal wound.

There are three factors which especially influence the extrusion of the ball. First, the size of the globe; second, the treatment of the muscles. I do not believe the suturing of the muscles to the capsule adds anything to the operation in the way of increased motility of the globe. The bringing together of the muscles in front of the sphere places too much strain upon the muscles which are already taut. In my early experience, the extrusions which I had were due, I believe, to the fastening of the muscles in front of the sphere—extrusion would take place between the muscles so fastened. The motility of the stump, is just as good if the muscles, after the tenotomy, are allowed to attach themselves without suturing. Since the adoption of this method, I find no difficulty in retaining a sphere of 20 mm. in the capsule of Tenon. The third factor which influences the retaining of the sphere is the pressure bandage to which Dr. Greenwood has already referred. This bandage should be kept in place for three or four days without a redressing of the eye. It prevents edema, and aids materially in obtaining good results.

DR. EDWARD STIEREN, Pittsburgh, Pa.: I have spoken so much on this matter before this and other societies that what I would say would simply be reiteration, except that I also feel very strongly that there is only one substance for implantation, and that is autogenous fat, for the reasons set forth in my paper before the Section on Ophthalmology, A. M. A. 1914. I have never had expulsion of the fat nor any cause to regret the procedure.

In regard to late implantations, as the Essayist states, the horizontal band of cicatricial tissue in the socket is just in the wrong place and most aggravating to deal with. It is my custom in overcoming this difficulty to make a curved incision upwards as high into the conjunctiva as is necessary and then dissect down a flap to the horizontal old scar. This is then undermined with blunt scissors, and a cavity of respectable depth is accomplished into which, after all hemorrhage has been checked, quite a good sized piece of fat can be introduced, and the flap is then sutured back into position. This makes a most satisfactory stump and the fat remains quite as permanently as after a recent transplantation.

DR. LEE MASTEN FRANCIS, Buffalo, N. Y.: I have always used silk

for these sutures, and do the classical plan of suturing Tenon's capsule, also the muscle and also the conjunctiva. Clamping the muscles as soon as they are dissected by means of hemostats renders it easy to identify them and facilitates the operation.

DR. LOPEZ, Atlanta, Ga.: I am sorry he did not mention more about the fat transplantation that has been mentioned. I have been using it the past two years and have had excellent results in selected cases, the same as in Mules' transplantation. I use forceps on the two lateral recti muscles, as they drop on the cheek, and through the superior rectus I run a double suture to the forehead. They will stay out of the way during the time of suturing Tenon's capsule.

DR. W. E. CARSON, Pittsburgh, Pa.: I have used the gold ball for implantation with quite uniform success, but in a recent case the gold ball threatened to extrude, the overlying tissues being retracted in such a way as to expose the gold ball for a circular area 6 mm. in diameter. Prompt extrusion was expected, but recalling the marked tendency for granulation tissue and scar formation to follow alkali burns of the conjunctiva, I took some Fehlings alkaline solution (10% K O H), which was the most convenient strong alkali solution at hand, and gently applied the same with a small applicator to the edges of the retracted tissues. This treatment was repeated twice a week for three weeks, at the end of which time exuberant granulations had completely covered the gold ball. At the end of six weeks there was a firm covering of strong scar tissue and the ball has since remained firmly in place.

DR. WALLACE RALSTON (closing discussion): I thank you for the free discussion. Dr. Francis, and I think some of the other gentlemen, have been using fat. I think Dr. Wheeler still uses fat to a considerable degree. It was the first material used in our work twelve years ago, and at that time the argument was brought forward that it would be absorbed. It is a fact that very little is absorbed. The first case I operated on twelve years ago has had little absorption of the fat; it is really fat and not connective tissue as some have suggested. You can see it just as clearly as immediately after the operation. I use glass in the clinic, and in my private patients, gold. I wish to take issue with one of the gentlemen in reference to the catching up of the four recti muscles. I think Dr. Greenwood's method is wrong, in that he catches up each muscle separately, thereby doing a great deal of traumatism to Tenon's capsule, the very thing you want to avoid. We realize there are three rings or landmarks in Tenon's capsule; the deep ring around the optic nerve itself; then the ring of recti muscles; then the superficial ring which you reach at the conjunctiva. By suturing the middle and superficial rings with purse string sutures, the operation is simplified and is just as satisfactory in every respect.

## SOME OBSERVATIONS ON THE STRUCTURE OF THE VITREOUS BODY.\*

F. PARK LEWIS, M.D., F.A.C.S.

BUFFALO, NEW YORK.

The actual structure of the vitreous body up to the present time has been a sealed book. It has generally been assumed by writers on the anatomy and pathology of the human eye, that this important structure, occupying four-fifths of the eyeball, was merely a transparent substance of gelatinous consistency, through which was found undefined stroma, and whose purpose was to support the retina and to serve as a medium through which light rays could pass to the terminal retinal nervous elements. Certain anatomists have gone somewhat further than this, more particularly the older observers, but the consensus of opinion has been as stated above. The purpose of this paper was to demonstrate that so far from being an undifferentiated mass, it is one of the most highly organized of our bodily structures, infinitely complicated but of so fine a quality and so resistant to injury of every kind, that its structural formation can be made visible only with the greatest difficulty. Experiments were recorded in which it was shown that when the fresh specimen was taken, the entire lenticular system could easily be removed from the eyeball *en masse*. After being immersed in distilled water for twenty-four hours, the hyaloid membrane surrounding the mass of vitreous substance absorbed sufficient water to separate it from the firmer tissues within. It then formed a balloon like membrane showing a high degree of elasticity. When this structure was coagulated by being put through a series of processes without reducing its size by hardening, the normal relationships of its constituent parts became visible. On removing the hyaloid membrane from the outer side, it was then found that the structures were lamellated and opening out very much like those of a rose. These folds were then found to overlap one above the other and were attached at the margin of the optic disc.

This was entirely in accordance with the findings discov-

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\*The original paper of Dr. Lewis was unfortunately lost, and it was necessary to use the above brief summary.—Editor.

ered by the corneal microscope as shown by Koeppé and Vogt. Reprints of the images as seen in the living eye were demonstrated, and it was pointed out that these were fibrillae, and the terminal endings of the lamellar structures found in these prepared specimens. In the human eye these structures were more complicated and showed a higher degree of functional activity than those found in the eye of the ox.

#### DISCUSSION.

DR. M. FEINGOLD, New Orleans, La.: When one touches on a problem which has been lying dormant for so many years, in spite of the great attraction that it must contain, one certainly deserves credit and thanks in a full measure. The problem has undoubtedly been fascinating and tickling our curiosity for so many years, and in spite of all this, there are less than five men possibly in the whole medical world that can say anything from their own personal experience concerning the structure of the vitreous. All of us can speak from hearsay, from the text books, and interesting it is that even those few that can speak from their own personal experience do not fully agree on the details of the structure of the vitreous. This must undoubtedly be due to the inherent difficulties of that structure, which make positive statements almost impossible. For that reason we owe thanks to Dr. Lewis that he has again opened that question. It comes very opportunely at this moment, that he comes forward with his own researches in this field, because we have another method at our disposal from which we expect a great deal of light. I mean the new slit lamp illumination with the Koeppé armamentarium. This, together with the researches of Dr. Lewis will help us more and give us an insight into this difficult structure. One thing in the experience of the doctor was to bring out facts already established by others.

On the other hand, the specimens he shows brings out another interesting fact, the anterior attachment of the vitreous and its intimate relation to the suspensory ligament of the capsule. I noticed on the specimens that they seemed to be attached on the front near the ciliary body to the suspensory ligament.

I belong to that very large class outside those who can say something from their own personal experience with vitreous. The vitreous we now see are actual specimens. Those pictures we see are undoubtedly different from the actual structures of the vitreous, and so I speak only in the hope that the researches of Dr. Lewis together with the method of Koeppé will awaken new interest in this mysterious body and stimulate every one to search and possibly find the solution of this taxing problem.

DR. WM. C. FINNOFF, Denver, Colo.: I am not one of the five men that have attempted to describe the vitreous, and I know less about it than Dr. Feingold. All that I have seen has been from my observation from sections of the eye under the microscope and Dr. Feingold has had greater experience in this than I. I think Dr. Lewis

is to be congratulated on his work, which certainly opens a new field for study of the structure of the vitreous.

DR. LEWIS (closing discussion): I will simply say that all of this work is preliminary. The fact has been demonstrated that the vitreous is a compound and highly involved body. There is no branch of our study that offers larger possibilities, and none to which attention can be more profitably given.

TRANSACTIONS  
OF THE  
TWENTY-SIXTH ANNUAL MEETING  
OF THE

American  
Academy of Ophthalmology  
and Oto-Laryngology

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OTO-LARYNGOLOGICAL DIVISION



## PT. I: PAPILLOMATA OF THE LARYNX WITH PRESENTATION OF PATIENTS.

CHEVALIER JACKSON, M.D., F.A.C.S.

PHILADELPHIA, PA.

The two patients presented to you here today illustrate clearly, it seems to me, the points that I have heretofore made in regard to multiple recurrent papillomata in children. When these patients first came to the clinic they were aphonic. One of them had already been tracheotomized for dyspnea, and the other was so dyspneic that tracheotomy was necessary. Both of them, as you see, have been cured of their papillomata; they have been decannulated, and as you hear, they have loud clear voices. Every now and then there is advocated some new form of radical procedure for dealing with these growths. Children continue to come in with their voices ruined and their larynges mutilated by radical surgery or overdosage with radium, or both. The futility of radical laryngeal work in cases of papillomata is shown by the fact, that in all of these cases, without exception, the growths have recurred not only at the site of removal, but elsewhere in the larynx, in the trachea or even in the fauces. This rough sketch that I make for you\* shows how, in one of many cases, a mass of papillomata recurred in the tonsillar fossa. I think no one will say that by radical work in the larynx he can prevent "recurrence" in the fauces. If the growths appeared only in the fauces after laryngeal removal, radical work would not be so bad; but they recur in the larynx at the site of removal, and possibly in dozens of other locations in the larynx, trachea, pharynx, fauces, and even on the lips and in the anterior nares.

The method of cure used in both these cases was simply the scalping off of the recurring buds of papillomatus repullulations as soon as they appeared, taking the utmost care to inflict not the slightest trauma to the normal tissues and avoiding any attempt at radical removal of the base of the growths. The instrument used is shown in Fig. 1.

I think the large number of cases exemplified by the two patients exhibited to you today justify the following conclusions:

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\*Reproduced in the color plate.

1. Multiple recurrent laryngeal papillomata constitute a benign selflimited disease.

2. Those occasional cases that recover after a single operation are examples of a short limit; or the operation has been done near the end of the time limit. The operator is apt to be misled into attributing a remarkable recovery to the particular method he happened to have used.

3. Papillomata repullulate on the surface; they do not infiltrate.

4. After removal of papillomata, no matter how radically, repullulations occur at the site of removal and new papillomata appear at new locations in the larynx, or even the pharynx, fauces, lips and anterior nares.

5. Even if you eviscerate the larynx, your patient will get well no quicker than if you removed the growths superficially, and evisceration will have irremediably ruined the voice.

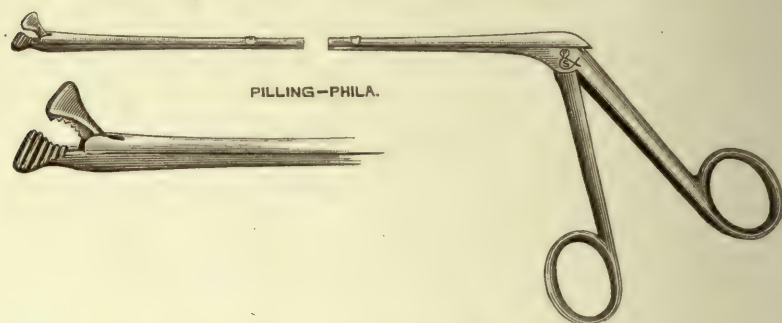


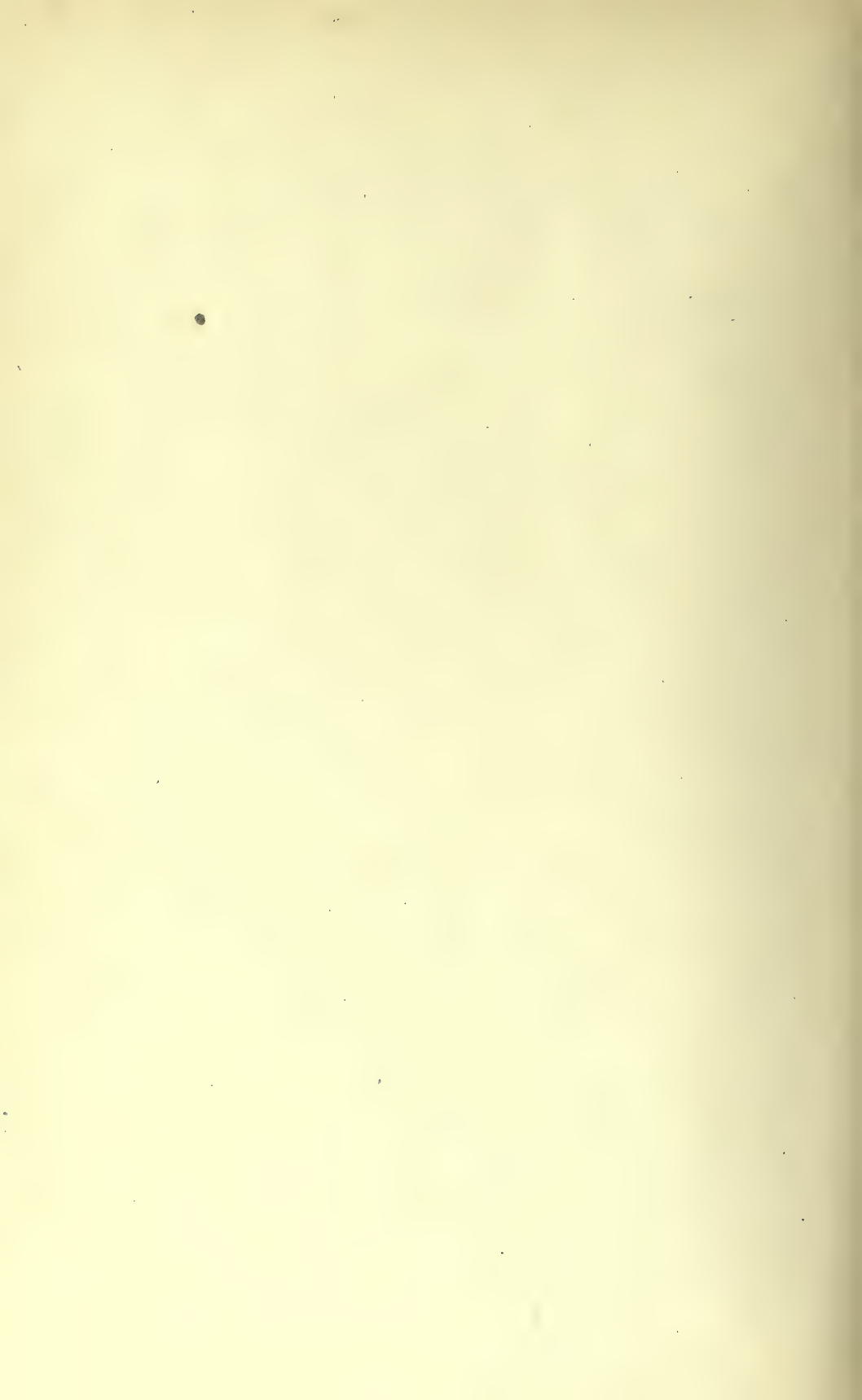
Fig. 1. Papilloma forceps for use through the direct laryngoscope in the superficial scalping off of recurrent multiple papillomata in children without injury to the base.

6. The methods employed in cancer are utterly out of place in cases of papillomata in children. Cancer is an infiltrating disease with no limits except the life of the patient. Unless stopped it has 100 per cent mortality. Multiple recurrent papillomata of children constitute a benign selflimited disease, usually ending in recovery if asphyxia is prevented. Scars, tissue destruction, vocal ruin, and radium burns are of no consequence in cancer; they are disaster in papilloma.

7. The best method of cure of multiple laryngeal papillomata is obtained by scalping off the projecting parts of the growths, without any attempt at removal of the base, repeating the procedure as often as repullulating buds appear. The removal requires but a minute or two with the direct laryn-



Fig. 2. Papillomata on the right side of the fauces of a child aged two years. These faucial growths appeared after the removal of recurrent laryngeal papillomata. Repullulation occurred at the site of removal and new papillomata appeared in the trachea.



goscope and proper forceps. No anesthetic, general or local is necessary, and a sedative is superfluous. Children two years of age will usually open their mouths and permit the removal without protest, when they know by previous seances exactly what to expect.

## PT. II: OVERLOOKED CASES OF FOREIGN BODY IN THE LUNG.

(Lantern Demonstration)

CHEVALIER JACKSON, M.D., F.A.C.S.,  
PHILADELPHIA, PA.

These lantern slides illustrate a series of twenty cases in which a foreign body in the lung had been overlooked, and in which the foreign body had produced all the symptoms of pulmonary abscess, bronchiectasis and pulmonary tuberculosis even to hemoptysis and fatal pulmonary hemorrhage. In many of the cases there was a very positive history of foreign body, but it had been ignored or brushed aside as unworthy of consideration. In other cases there was no history of foreign body, the patients or the parents being unable to state when the accident occurred, though it was clearly evident by the duration of the septic pulmonary symptoms, that the foreign body had been in the lung for many years—in one case 35 years. In the latter case, extensive epithelioma of the lung was a sequel. The duration of the other overlooked cases ranged from one to 28 years. The purpose of the demonstration is to illustrate the necessity for the consideration of foreign body as a diagnostic possibility to be excluded in every case of acute or chronic pulmonary disease, and to bring out a discussion of the diagnosis of foreign body in the lung.

## LOCALIZATION OF LUNG ABSCESES.

HENRY LOWNDES LYNNAH, M.D.

NEW YORK CITY.

Localization of lung abscesses may be accomplished by the following measures:

1. Physical examination of the chest by a competent internist.
2. Roentgenography of the thorax both antero-posterior and lateral in erect and recumbent posture, and stereoscopic.
3. Matching the plates with cadaveric films of the tracheo-bronchial tree.
4. Bronchoscopy. Suction evacuation of lobe bronchus involved. Reroentgenography and rematching with cadaveric tracheo-bronchial tree.
5. Bronchoscopic injection of opaque mixtures.

Of the foregoing, bronchoscopic localization seems to be the most accurate, but all of the other aids taken together makes very definite localization possible.

In the study of such cases, Dr. Wm. H. Stewart and the writer have learned to rely on suction bronchoscopy and roentgenography as a very important factor in arriving at a conclusion as to the exact location of the lobe branch and lung involved. In the initial X-ray plate taken before bronchoscopic suction evacuation, there is often a large opaque area which casts an indefinite shadow referable to the greater portion of the lobe of the lung which is in fact not involved. After suction evacuation the abscess cavity or cavities are much more easily interpreted, even before the bismuth-oil mixture is injected. However, at times when we are dealing with a small cavity, suction evacuation will clear up the lung to such a degree that it then becomes necessary to inject some opaque mixture for purposes of localization.

1. Stethoscopic Localization. Stethoscopic examination is extremely important as an aid to diagnosis as well as localization of the lobe of the lung involved. Dr. Otto M. Schwerdtfeger has made very careful physical examination of the chest of these patients before the roentgenographic plates are taken, and has given us very definite data as to the lobe involved. His findings are usually confirmed after the plates are developed.

2. Roentgenographic plates should be made in all positions to locate levels of fluid, etc. At times plates can be made only in recumbent posture, the patient being too ill to sit or stand erect.

3. Overlay films of the cadaveric tracheo-bronchial tree as recommended by Jackson, and also the films developed by Le Wald and the writer for localization of diphtheritic tracheo-bronchitis and abscesses following diphtheria.

4. Bronchoscopy. Bronchoscopic localization of the bronchus from which pus continues to ooze, is one of the most definite points in localization. However, pus may come from



Fig. 1. Dense "Pus Sponge Soaked Lung" shadow over the right upper lobe. No definite outline of the abscess cavity is seen. (Plate by Wm. H. Stewart.)

the mouth of the right or left upper lobe bronchus, and there may be some difficulty in determining whether the ascending or descending branches are involved. Often pus is seen in all of the branch bronchi, and it is only after suction evacuation of each individual bronchus that the chief offender is detected. After removing pus from the bronchi not involved, the patient is instructed to cough. If no pus continues to pour from these branches with coughing, one can state with a fair amount of accuracy that such branches are not involved, and do not communicate with the

abscess cavity. The branch bronchus from which pus continues to be ejected with each cough, in spite of suction, is the offending lobe branch which communicates with the abscess cavity. Suction evacuation is a very important factor in arriving at definite localization, both for the bronchoscopist and roentgenologist. There is frequently seen in the initial roentgenographs a large dull opaque area surrounding the abscess cavity. This opacity may be very dense at times, making roentgenographic interpretation extremely difficult. (Fig. 1.) This dense opacity we have learned to call the "pus sponge soaked" lung, and this no doubt is a factor in producing the enormous amount of expectoration by patients in whom the abscess cavity by bismuth injection has been interpreted as being extremely small. Clearing of the surrounding "pus sponge soaked" lung by suction bronchoscopy and immediate roentgenography has given us much more definite ideas of the exact locality of the abscess.

The comparison of the plates before and after suction bronchoscopy is remarkable. Usually the abscess cavity can be distinctly seen, and its walls are much more definitely outlined. However, levels of fluid and gas bubbles as interpreted by the initial plates do not always disappear. (Fig. 2.) This brings up a very important point which has bothered the writer for some time. Are abscesses of the lung so enormous in some instances that they show levels of fluid and gas bubbles above the fluid? Or is it a compression of the surrounding lung structure which makes this peculiar appearance on the X-ray plate? Of course not all of the lobe is involved by the abscess cavity, and there must necessarily be some normal compressed lung plus adhesions, which may account for some of these interpretations. I am not for one moment intending to criticize the interpretations of such expert roentgenologists as Stewart, Hirsch, Le Wald and Gottlieb in New York, or Manges or Bowen in Philadelphia. This is certainly not my intention, for I am no expert reader of radiographic plates, but this idea has occurred to me more than once while looking over plates, and while I have asked many questions about this being a possible factor in throwing us off on definite interpretation of abscess cavities, I have so far had no convincing answer to these questions as to what happens to the normal lung structure surrounding the cavity.

In cases diagnosed as bronchiectasis, the interpretation is different. (Fig. 3.) If the bronchial wall remains intact and does

not become eroded by perichondritis, then we have a true sac-culation or bronchiectasis, which is mapped out beautifully by the injection of the bismuth mixture. However, on the other hand, the bronchial wall may become eroded, and then we have an abscess cavity within lung structure. To distinguish between bronchiectasis and true pulmonary abscess within lung structure is at times extremely difficult. Of course when we encounter a bronchial stenosis we are almost sure to find a dilated bronchus filled with pus below the structure.

THE APPEARANCE OF THE BRANCH BRONCHI. In acute cases there is usually seen an edematous mouth of the bronchus



Fig. 2. Demonstration of the value of Suction Bronchoscopy. The "pus sponge soaked" shadow has disappeared. The abscess cavity can be plainly seen, for the level of fluid and air bubble still remains. (Plate by Wm. H. Stewart.)

from which pus is oozing. The edema partially obstructs the bronchus and hinders free drainage. Often an inflammatory plaque, which resembles a diphtheritic exudate, surrounds the mouth of the edematous bronchus and further obstructs drainage. The removal of this exudate is invariably followed by considerable bloody ooze. In further advanced cases, it is not infrequent to see after the removal of these fibrinous sloughs, that there is some erosion of cartilage with many fungating granulations present. These granulations bleed

freely to the slightest touch, and is probably one of the causes of hemorrhagic expectoration in all of these subjects. Severe and even fatal hemorrhage may occur from erosion of vessels

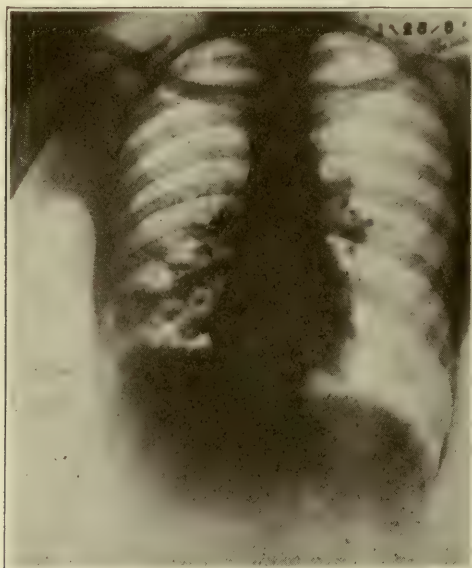


Fig. 3. Bronchiectatic cavity of a mesial branch and in the heart shadow. Definite localization was made possible after the injection of the author's bismuth mixture. (Plate by Wm. H. Stewart.)



Fig. 4. Microphotograph of a transsection at the carina of the trachea from a case of diphtheritic tracheobronchitis. Note both of the main bronchi are occluded with diphtheritic membrane.

within the abscess cavity. I am not referring to this type of hemorrhage, for we never bronchoscope a patient with such a history. I am referring to the bloody expectoration which

is produced by the presence of fungating granulations. (Fig. 4.) In diphtheritic tracheo-bronchitis, fungating granulations are frequently present, especially in advanced cases. At times sloughs of cartilage and fungating infected tissue is responsible for a

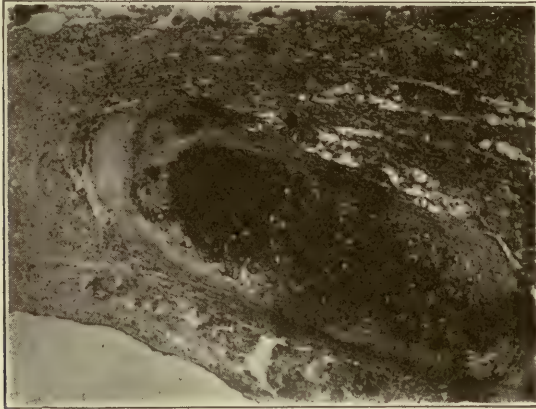


Fig. 5. High magnification of the cartilage of the right main bronchus. There is marked degree of perichondritis and sloughing of tissue. Enormous proliferation of small round cells and many giant cells throughout the specimen.

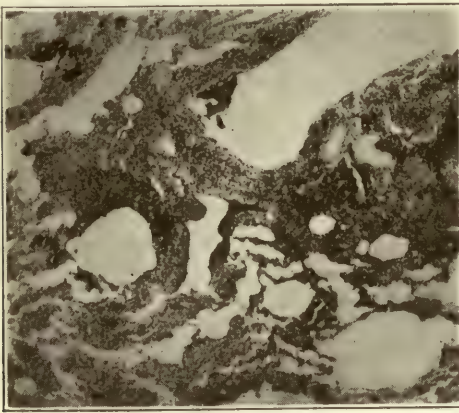


Fig. 6. Diphtheritic bronchopneumonia. This occurs primarily in many instances. The lung may become necrotic and numerous abscesses result.

terminal pneumonia after the acute diphtheritic process has apparently subsided. (Fig. 5.) When sloughs of tissue and cartilage fall down deeper into the bronchi, we have in reality a true foreign body pneumonia. The usual sequel is a pulmonary

abscess if the foreign body is not removed. (Fig. 6, Fig. 7.)

The writer has seen many cases of postinfluenzal bronchiectasis. In a few, tonsillectomy had been performed under general anesthesia, and they were recorded as abscess of the lung following tonsillectomy, when in reality they had been expectorating pus some weeks prior to the operation. The etiology of pulmonary abscess is too great a subject to discuss in this short paper. It has already been covered extensively in one of the former papers on this subject.<sup>1</sup>

CASE HISTORY. Mrs. A., a woman of twenty-four years, developed a pulmonary abscess following tonsillectomy. She

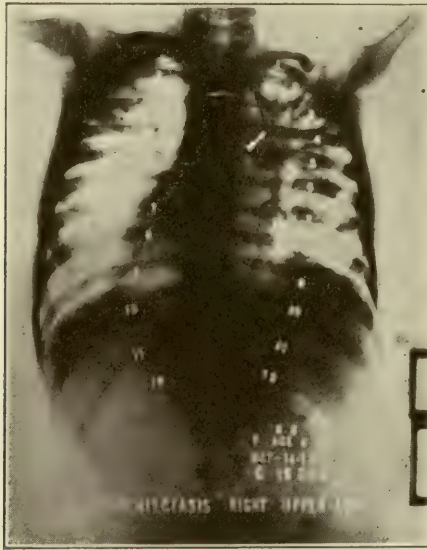


Fig. 7. A recovered case of right upper lobe diphtheritic abscess. Note the fibrosis which has taken place in the right upper lobe as the abscess cavity healed.

was referred to the Bronchoscopic Clinic at the Lenox Hill Hospital by the doctor who had removed her tonsils the week before. Everything went well following the operation until the ninth day, when she developed a cough and began expectorating large quantities of pus. At first she refused to go to the hospital, for she said she had already had enough trouble at the other hospital where her tonsils were removed. Finally she consented to go to the hospital for bronchoscopic treatment and was admitted. After a careful physical examination by Dr. Schwerdtfeger, she was referred to the X-ray room for a

series of plates. The first plates showed an enormous shadow involving the whole of the right upper lobe of the lung. The cavity as interpreted by Dr. Wm. H. Stewart appeared to be of enormous size, with a level of fluid and an air bubble above the fluid. It was localized as being in the right upper lobe communicating with the ascending branches. (Fig. 8.) It was anterior. The patient was prepared for bronchoscopic examination the following morning, after the initial plates had been again studied by Dr. Stewart and myself. Pus was seen coming from all of the bronchi. It was removed first from the middle and lower lobe branches and then the patient was instructed to cough. As these branches remained free on coughing, the superior lobe branch was explored. The mouth of the upper lobe bronchus was edematous and covered by a thick fibrinous slough. After removal of this slough, the branch appeared more open. A 5 mm. by 40



Fig. 8. A great aid to localization by means of matching the plate with an overlay film of the tracheobronchial tree. The abscess cavity after suction bronchoscopy was located in the right upper lobe communicating with the ascending branches. (Plate by Wm. H. Stewart.)

cm. bronchoscope was gently introduced into the mouth of the upper lobe branch bronchus as far as it would go. With each cough pus was ejected into the bronchoscopic tube. With a long, curved, spiral suction cannula, the ascending branch was evacuated by suction. The curved spiral was directed anteriorly, for we had localized the cavity to be anterior. However, before the spiral suction cannula was removed, it was turned posteriorly, so as to evacuate as well as possible all of the sponge soaked area. After ten minutes bronchoscopic suction evacuation, the bronchoscopic tube was removed. There was some blood in the purulent material

evacuated by suction. This was sent to the laboratory in a sterile suction bottle which had been used. The patient was immediately returned to the radiographic room for more plates. On roentgenography the pus soaked area had disappeared, and the abscess cavity as originally interpreted by Dr. Stewart to be of enormous size proved to be correct. There was a large cavity with the same level of fluid and air bubble, which was much clearer than in the initial plates. Here was an example of what suction bronchoscopy would do as an aid to definite localization. But why was the level of fluid still in the abscess cavity after such clearance of the surrounding

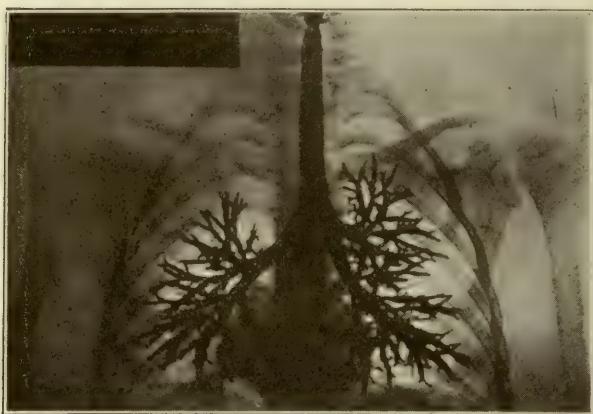


Fig. 9. Cadaveric plate of the tracheo-bronchial tree. Very useful as an aid in the localization of lung abscesses. (Plate by L. T. Le Wald.)

lung structure of pus? This is the point that I made earlier in this paper, and it is certainly a difficult one to comprehend. Here is a patient with an enormous lung abscess following tonsillectomy, with a large amount of expectoration on the ninth day. She is bronchosoped on the eleventh day, and the whole picture is changed after the removal of an obstructing slough in the mouth of the right upper lobe bronchus. What is the cause of the change in the density of the lung after suction bronchoscopy, and why has the level of fluid persisted when the surrounding lung shadow has disappeared? Again, could an abscess cavity of so short duration be of such proportions? The opaque bismuth mixture was not injected, but was to have been injected at a later date and further studies made. There was a severe reaction following the examination, and the temperature reached 105.3° F. the same

evening. There was a distressing cough, but not the expectoration which she had prior to bronchoscopic examination. The following day the patient had slightly improved. She continued to expectorate a small amount of pus until the sixteenth day after tonsillectomy and the sixth day after bronchoscopy. She was so much improved on this day and was so anxious to leave the hospital, that Dr. Willy Meyer gave her permission to return home. She refused further bronchoscopy, which did not speak well for my one treatment. However, it seemed to have been beneficial, for she continued to improve and was pus free. She had had no further trouble and at the present time, some six months later, is in good health.

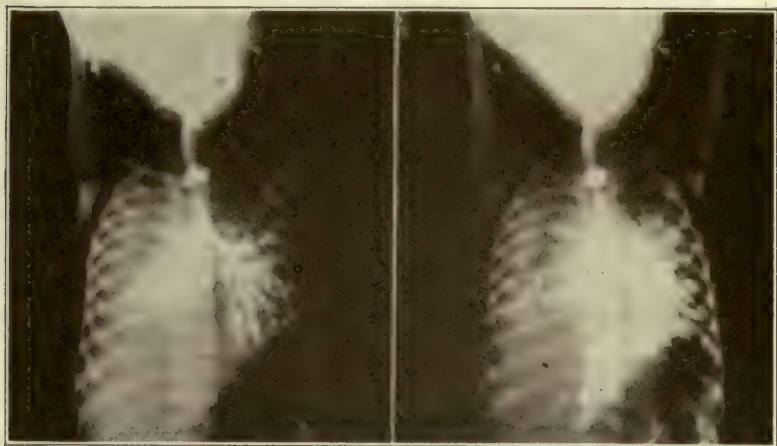


Fig. 10. Cadaveric Positive Stereoscopic Plates. These are cadaveric films for localization in children as well as adults. Stereoscopic overlays seem to give a better interpretation than the flat overlay films. (Plate by L. T. Le Wald.)

Now there are some lessons to be learned from this case history.

1. Was the shadow an abscess cavity, or was it a consolidation of the anterior portion of the lung?

2. Are all so-called lung abscesses a pneumonic process before definite cavitation has taken place? In this case there was definite cavitation shown by the X-ray plates, and also a level of fluid and an air bubble in the cavity.

3. Could an abscess cavity of such size develop in so short a period unless there had been some focus in the apex of the lung prior to tonsillectomy?

4. Was the fibrinous slough obstructing the mouth of the right upper lobe the sole cause of retention of secretion which could produce such a cavity by radiographic interpretation?

5. Was it possible to cure an abscess cavity of such proportions by one bronchoscopic suction evacuation?

These are some of the puzzlings questions which arise in the study of all pulmonary abscesses. Of course, this may have been a spontaneous cure after the removal of the foreign body slough; but the great difficulty is to comprehend why so large an abscess cavity in the most difficult portion of the



Fig. 11. Bronchoscopic views of diphtheritic tracheobronchitis. Top row to left; normal view of the bifurcation. To the right; membrane in both bronchi. The lower row shows to the left the left bronchus completely obstructed, and to the right there is involvement of all of the lobe branches of the right lung. (Photograph of water color sketch from life by author.)

lung to drain should be completely evacuated and heal in so short a period.

It seems to me from this lesson that there is still a great deal to be learned both in the interpretation of lung abscesses and the treatment of these conditions.

#### BIBLIOGRAPHY.

Lynah, H. L. The Etiology of Pulmonary Abscess. Trans. N. Y. Acad. Med., Feby., 1921.

## SOME OF THE PROBLEMS WHICH MAY CONFRONT THE OCCASIONAL BRONCHO-ESOPHAGOSCOPIST.

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The term "occasional" is used advisedly as applying to the majority of those who undertake to do broncho-esophagocopy, for there are very few to whom cases of the character demanding this kind of instrumentation come with sufficient frequency and regularity to exempt them from this classification. So it is to us that the problems are more real, although I think I am justified in saying that broncho-esophagocopy is nearly always more or less a problem to anyone.

Early in my career as a dilettante broncho-esophagoscopist, before the chastening hand of experience had been laid upon me, with that temerity which so often is found in the beginner, I sought to explain the relative advantages and disadvantages of the proximally lighted tubes, as exemplified by the instruments of Bruenings, and those with distal illumination, so cleverly devised by Jackson, concluding that at my hands the proximally lighted instruments were superior.

Several years of practical application have intervened since this illuminating essay of mine was perpetrated upon an unsuspecting scientific body, and I find that I am now using the Jackson instruments in three-fourths of my cases, resorting to those of Bruenings only in esophageal cases in the adult. With cocain anesthesia, the proximally illuminated Bruenings tubes, with their comparatively larger lumen, can be used more advantageously by me than the Jackson tubes, but for bronchial work and esophagocopy in the child, my experience has led me to use almost exclusively the Jackson type of instruments, the especial advantage that I have found in the distally illuminated instruments being the absence of unwieldy top-hamper, so to speak, giving greater freedom of movement, and the otherwise less cumbersome character of the tubes. The greatest disadvantage that I have found is in the obscuring of the small lamp in the end of the tube by secretions or blood, which of course can be removed by sponging or suction. On one occasion I lost a lamp from a bronchoscope deep in a main stem bronchus, through its

breaking from its base, but as the case was in extremis, this accident did not add to the gravity of the condition.

It was some years ago that the dean of American peroral endoscopists raised his voice against too protracted endeavor to remove bronchial foreign bodies. I believe as a general rule he established a time limit of twenty minutes for a seance, especially in young children, and it is almost axiomatic that a bronchoscopy continued longer than thirty minutes is dangerous. I am sorry that this dictum has not, as evidenced in practice, been adopted as a cardinal principle by all bronchoesophagoscopists. My own experience has been that if I do not secure a foreign body in that limit, the exacting nature of the work has made me nervous, perhaps exhausted the patient, and further attempts at this time are quite likely to prove futile, and may result disastrously to the patient. Sometimes a fatality follows such prolonged effort, whereas postponement of further search until a future time—perhaps the next day—probably would have been attended by success. I realize that this is a trite proposition, but that I am justified in bringing it to the attention of this body is exemplified in the fact that only last year I saw a child with a needle in the lung, who a few days previously had been bronchoscoped under ether by a very skillful colleague of mine, who, I was informed, had worked two or more hours continuously endeavoring to remove the needle. When I saw the little girl several days later she was profoundly septic, with pneumonia and a lung abscess, dying shortly afterward. The child would, of course, have died anyhow without removal of the needle, but I am citing this case as one where perhaps two or three short seances might have ended in success, for I am convinced that after a few minutes work with a tube in the lung, the condition of the tissues must have been so congested, and the operator so disturbed and nervous over his lack of success, that further attempts necessarily would have failed. Yet we all hate to give up at the first attempt.

Reference to general anesthesia in the case just mentioned brings up the all important question of whether a general anesthetic should be used in our bronchoscopic cases. This question is of more importance to the occasional operator than it is to one of Jackson's great skill, for we have all, I hope, witnessed the dexterity with which he works without a general anesthetic in these cases. However, everyone cannot be

a master technician, so this question comes keenly home to those of us who are not in constant practice in this work.

In discussing a paper before the Oto-Laryngological Section of the American Medical Association at Boston last June, I related my experience in removing cockle-burs from the larynx, and stated that where I had to deal with such foreign bodies in young children, I put them under ether. Someone who joined in the discussion said that he disagreed with me as to the use of general anesthesia, as he thought this should never be used in bronchoscopy. Now if this commentator had ever had occasion to remove a cockle-bur from the larynx of a struggling child, in great pain from the spines of the bur, which were buried in the vocal cords and spasmodically held there, I am sure he would not discourage the use of ether to render the process of removal painless, and to relax the convulsive cords. But when we consider purely bronchoscopic cases, I may say that in later years, as I grow more experienced, if not more skillful, I have been using general anesthesia less and less, yet I would not say that I never use it, for I have cases occasionally where I am glad to have its aid.

It is pertinent to mention two cases from my own experience, which illustrate the disadvantages of general anesthesia, and as one of the problems of the occasional broncho-esophagoscopist, may serve as a warning in technic.

A child two years of age had a large lima bean in its trachea. The bean could be heard moving up and down in the trachea with respiration. Ether was administered, and a Jackson speculum passed to the larynx. Just as this was done the bean jumped up between the vocal cords, was held there spasmodically, and the child turned blue. Death from asphyxiation was imminent. Quickly removing the speculum, I put my mouth over that of the child, blew with force, the bean jumped back into the trachea, and the child promptly rallied. The next day, without anesthesia, the bean was removed without difficulty.

Another case was a tragedy.

A child of the same age—two years—had a lima bean in the trachea. That the bean had swelled was apparent from the labored respiration, and this should have been my warning. Ether was given, but just as I began introducing the Jackson speculum, a deep inspiration sucked the greatly swollen bean down to and across the bifurcation, and the little patient

immediately was asphyxiated. Tracheotomy was done at once, and a hurried attempt made to remove the swollen and softened bean, but the child was past our efforts at resuscitation before this was accomplished.

Had I here avoided the use of general anesthesia, the expulsive efforts of coughing probably would have prevented this unfortunate accident.

The chief disadvantages in the use of a general anesthetic—especially ether—are the loss of the involuntary reflexes, which aid in expulsion, and the increased congestion and flow of mucus with such an anesthetic. The advantages are the control of older children, and a relaxation which sometimes facilitates the removal of sharp and pointed bodies. Lye strictures of the esophagus in young children, which are rather common, are in my experience handled much more satisfactorily without general anesthesia, although as a rule these are dilated under general anesthesia. An esophageal foreign body, such as an open safety pin, for instance, doubtless could be handled by an occasional operator with greater facility under a general anesthetic, but on the whole, as one becomes accustomed to working without general anesthesia, there is infinite satisfaction, and a sense of freedom from worry about the anesthetic, which one can never have if one is mindful of its dangers in this kind of work.

Does it seem possible that an expert radiographer could mistake the location of an eight-penny nail in the trachea of a two-year old child, and insist that it was in the esophagus, from a fluroscopic examination? This is a problem that came to me several years ago, and caused me to berate my lack of selfassertion, for my opinion, as then expressed, was that the nail was in the trachea. There were almost no symptoms of obstruction, but the child died on the table while I was searching with an esophagoscope for the nail in the esophagus, and an immediate tracheotomy, with removal of the nail from the trachea, failed to save a life, where the following of my first impulse, to bronchoscope the patient, might have done this.

Mention of the use of the fluroscope gives me an opportunity to emphasize the value of this adjuvant in locating bronchial foreign bodies and in passing the bronchoscope down to these. Sometimes we encounter cases where the amount of secretion is so great that we have considerable difficulty in seeing the foreign body as the tube approaches it.

In such cases the tube can be passed gently down to the object, while its progress is watched under the fluroscope. This procedure doubtless will appeal more to the occasional bronchoscopist, but its value is not negligible, and its employment is not necessarily a confession of lack of skill in bronchoscopy.

Gentleness in manipulation is so essential in this kind of work that it almost would seem unnecessary to call attention to its importance, but it is the occasional broncho-esophagoscopist who is most likely to violate this rule, so I am adding my plea to that of other, more experienced workers, when care and a light touch are urged. I almost shiver as I read this when I recall the shoving and tugging of tubes and forceps that I have witnessed in some instances where the operator lacked in skill and patience. I have never seen a time where it was necessary to use force in passing either a bronschoscope or an esophagoscope, and a forceps should never be closed and traction made except under the guidance of direct ocular observation, or sometimes with the aid of the fluroscope.

Even with the utmost care tissues at times are bruised or lacerated, so where this has been done, postoperative care and watching must be constant until all danger is past. Subglottic edema from traumatism of the tissues has carried off a number of patients through asphyxiation, and to my chapter of calamities I can add one of these.

Late one afternoon, I removed a large overall button from the esophagus of a two-year old child. In extracting this, the tissues just back of the larynx were bruised, so realizing the possibility of edema, I had a cold pack applied, and instructed the nurse in charge of the ward to call me if breathing became difficult. This was not done, and the child toward morning slowly became asphyxiated, dying where an immediate tracheotomy would have saved it.

When breathing is bad in any of these cases, pre- or postoperative, a tracheotomy should be done. An early tracheotomy will save the life of many a child. It isn't always easy to determine the cause and location of obstruction to breathing, so if the condition is bad, it is better to do a tracheotomy, and then afterward seek to remove the cause. This has come home to me in a number of instances. I recall a case, in an infant one year of age, where I had done a hurried bronchoscopy looking for a chicken bone, which I did not find,

and was sitting that evening very serenely enjoying a movie when, to my astonishment, I saw flashed on the screen the undesired advertisement that I was wanted, and found the hospital calling me with the information that the child was choking to death. Arriving there, I saw that this was not exaggerated, so did a tracheotomy, the chicken bone popped out, and the child was saved.

The moral of this is: Don't delay doing a tracheotomy where breathing is bad.

A certain well known text-book, with the contents of which some of us doubtless are not any too well acquainted, says, "By their fruits shall ye know them," and I trust that as I have gone along recounting my own mistakes in the technic of broncho-esophagoscopy, you will not conclude that my percentage of failures overbalances that of my successes, for I am merely holding up the other side of the shield, to present some of the problems which have come to me, notably several years back. I am frank in admitting the loss of patients which a richer experience might have saved, but I am also not unmindful of the fact that a very large percentage of my cases has been successful.

In my preamble I stated that practically any case of broncho-esophagoscopy is a problem and we have the oft repeated confession of our greatest peroral endoscopist to the effect that his large degree of success has been due to the study he has given his individual cases.

#### BIBLIOGRAPHY.

1. McKinney, R. Brief Comparison of Technic of Broncho-Esophagoscopy with Jackson's and Bruenings' Method. Southern Medical Journal, September, 1913.

#### DISCUSSION OF

#### DRS. JACKSON'S, McKINNEY'S AND LYNNAH'S PAPERS.

DR. THOMAS McCRAE, Philadelphia: It is unnecessary before this gathering to mention what Dr. Jackson has done in your special field, but perhaps you do not realize how much he has done for internal medicine by bringing to our attention these cases of foreign bodies in the bronchi. We are only beginning to realize the frequency of this condition. It would be interesting to know how many patients there are in the United States to-day with undiagnosed foreign body. I do not know—nobody knows. All we can say is that there are many of them, and some will go under the sod carrying the foreign body with them. That state of affairs should be a stimulus, not only to the workers in your field, but to the men in general practice and those working particularly in internal medicine.

The removal of these bodies is your special field of work, and once the diagnosis is made there is no doubt that with skilful hands the foreign body will be removed. Why are these cases missed? There are many reasons. In the first place, there is the remarkable fact that foreign bodies can pass through the larynx and into the bronchus without causing marked symptoms. Several of the cases shown on Doctor Jackson's plates demonstrate this. It is there that you sometimes have the opportunity. Possibly there is a certain amount of irritation of the larynx, and you may be asked to see these patients. Your suspicions may be aroused, though your investigation of the larynx may not show very much. Another difficulty comes in the acute cases, which arise particularly in young children, and are due to the presence of some form of nut, often the peanut, in the air passages. It is a question whether you will see these patients very often unless someone else has been alert enough to be suspicious. In many cases, the diagnosis of pneumonia is made. The younger the child, the more acute the process, the more difficult the examination, and the easier it is to make a diagnosis of pneumonia and let it go at that. Personally, I have yet to see pneumonia associated with a foreign body.

The physical signs that are suggestive in these children with acute peanut bronchitis, are fever, distress, dyspnea, cyanosis and auscultatory signs throughout the chest, without there being any definite evidence of pneumonia. The emphysema on the affected side, due to the nut acting as a ball valve, is very suggestive.

In the group which we may call "chronic," the patient may have a foreign body as long as thirty or forty years. How much chance you have of seeing these patients compared with the man in internal medicine, I do not know. Undoubtedly you see a certain number of them—perhaps on account of a persistent cough. If there is nothing in the throat or larynx, the patient may be dismissed. We see them from a different standpoint, that of chronic thoracic disease, and the diagnosis may be missed because, first, men do not know about foreign bodies, and, second, because they do not examine carefully. One of the greatest curses in internal medicine is the tendency for men to trust to the X-ray, to the laboratory procedure. When the question of thoracic diagnosis comes up men are too apt to say, "Let's have an X-ray and see what it is." That is a curse because we neglect proper examination, and in the case of foreign bodies there are some which the X-ray does not show. We should study all cases with the X-ray, but we should also apply our knowledge to the recognition of cases in which the X-ray shows no foreign body. It is very interesting to be able to make a tentative diagnosis of foreign body and its location without there being anything on the plate. But internists can only do that when we study thoracic signs carefully, and study the cases in which we have foreign body shown by the X-ray, so that we may apply our knowledge to the others. The patient with a safety pin in the bronchus will show a different clinical picture from that of a tack, or a piece of bone. The point of special interest in the plate that showed the safety pin, for instance, was that the patient showed diminished expansion on that side. Why

should a safety pin in the bronchus, that does not interfere with the passage of air, cause diminished expansion? It is an interesting problem. In some patients one sign is the presence of fine crackling rales over small areas, found in some patients with small metallic bodies. When we have a plugged bronchus, there is an entirely different picture, but it may be complicated by the fact that the stoppage may not be constant. At one time air gets past and at another time it does not, with marked change in the signs. When the bronchus is plugged, if the condition lasts any length of time, there is a fairly definite picture of diminished expansion, absence of vocal fremitus, dullness, and absence of breath sounds.

Then the shifting of foreign bodies causes difficulty. You know more about that than I do, but a foreign body may shift, and of course this alters the clinical picture materially. Another mistake made is in the differentiation from tuberculosis, although I do not think an internist worthy of the name would do that, because the signs are very different.

Then we have the problem of the secretions. With a foreign body on one side, the secretions may pass to the other side, giving a picture that is puzzling, but with a little study is comparatively clear. The same thing applies to foreign bodies in the esophagus—secretions from the esophagus may go down into the trachea.

One other point in regard to diagnosis, the condition may be diagnosed as pleurisy. It is rather interesting to hear the histories. One person who died from hemorrhage had a foreign body for over thirty years, and about the age of eight had an operation done on the pleura, with apparently a diagnosis of empyema. Careful study should make that mistake very unlikely.

Then the problem may be complicated by abscess. Very little need be said about that, except to emphasize the point that wherever abscess is found, without reasonable explanation, we should consider the question of foreign body.

We should keep in mind the possibility of foreign body. As long as we do not have it in mind, the diagnosis is not apt to be made, so that we should think of the possibility of a foreign body. We have missed these cases in the past; possibly we may miss them in the future; but we will miss fewer if we have in mind the possibility that such a thing exists.

DR. JOHN W. MURPHY, Cincinnati, Ohio: In taking up the first paper: I think Doctor Jackson has brought before us a very important point that we should remember in a case of papilloma. All of us doing this work have prided ourselves upon the fact that we have been able to cure these cases by operation. We know now that the cases would have gotten well if we had not operated, and I am satisfied that some of our early operations were entirely too radical, believing that every particle of the papillomatous material should be removed. We know now from experience that that is not necessary.

Just one point I wish to call to your attention, and that is that in a case of papilloma an anesthetic is a very dangerous proposition. The labored breathing of the child with papilloma, with the full action of the cord, may carry the child along; but the moment the action of

the cord is interfered with by the anesthetic you suddenly have collapse of the patient and a hurried tracheotomy is necessary. That has occurred to me several times. Now I never attempt an anesthetic where there is papillomatous obstruction of the larynx. We all know from experience that we can get along without a general anesthetic in these cases. I consider that the anesthetic adds a point of danger, and if we are able to handle these cases without an anesthetic I am sure we are removing one of the danger points. It is very seldom now that I use either a local or a general anesthetic.

It is very important in these cases of young children, before proceeding with any instrumental manipulations, to see that the hands of the patient are firmly bound to the body, as any twist of your instrument may seriously interfere with the operation. In all these cases I have the nurse wrap the child in a sheet, first tying the hands to the body, so there is no possibility of the patient grabbing an instrument.

In the case of bones in the esophagus I want to call your attention to the fact that the X-ray does not always disclose the bone. That is due to the fact that when the X-ray man is asked to take the picture he often expects to find it in the upper part of the larynx, and therefore he may miss it when it is lower down. Within the last year I had a case that had a chicken bone in the esophagus for six weeks. They had seen a number of men, and one man was even willing to take out the woman's tonsils as the cause of the trouble—a woman fifty years old. She insisted that there was a foreign body there, but the X-ray plates failed to show it. Examination with the esophagoscope showed quite a large bone lodged just at the opening of the esophagus into the stomach. It had been there six weeks and quite a large ulcer was present. Its removal was successful, however, and the case made a good recovery.

In speaking of the foreign bodies in which a diagnosis is made of tuberculosis, I think that is a more frequent cause of tuberculosis than of pneumonia. I had within the past year a case that had been treated for twenty years for tuberculosis, which had gone the rounds of the various sanatoria, and finally fell into the hands of one of our X-ray men, who discovered a beauty pin in the lung that had been there for eighteen years, so of course tuberculosis was not the trouble.

With reference to Doctor Lynah's paper on lung abscess, I have had no practical experience in this, but I realize that Doctor Lynah is a pioneer in a very important line. These lung abscesses when properly diagnosed and handled can be cured. I want to ask the doctor in closing to state a little more clearly about the amount of bismuth he is usually able to use in these cases, and if any attempt is made to extract any of the bismuth after the examination, or if Nature is allowed to take its course.

Referring to Doctor McKinney's paper. We have all had experience with the Bruenings and Jackson tubes. I believe it is better to decide upon one or the other and then adhere to that. You will become expert in using one tube when someone else may be expert in using the other. I have both, but it is very seldom that I use the Bruening.

DR. HENRY R. FORBES, New York City: The field of bronchoscopy has been broadened and developed by many workers, including the pioneer work of our worthy President. We are able to assist the in-

ternist in diagnosis, and we go still further and help these patients by our therapeutic efforts. The washing out of abscess cavities in the lung, the use of argyrol solution, or of dilute iodine solution, (the latter I think our President was the first to use in New York), have been of decided benefit, and now we have this method in the use of bismuth, both for diagnosis as well as treatment. All this brings to our minds the fact that bronchoscopists have gotten out of the field of mere removal of foreign bodies, and that we can assist the internist in many of his lung conditions.

From the papers that have been read, you can see that the large centers are doing a lot of this work. On the other hand, I want you all to remember that there are men going out from Philadelphia and from New York who have been taught at least the fundamental principles of bronchoscopy, and that better work is being done by bronchoscopists throughout the country than ever before. The method of using force is being curtailed, for force is the very last thing to employ.

DR. CHARLES W. RICHARDSON, Washington, D. C.: I wish to speak simply on lung abscess. It seems to me that Doctor McCrae gave us a very important lesson. We must cease to be mechanical and laboratory diagnosticians; we must use our clinical knowledge and our common sense in diagnosis. Lung abscess is one condition that really has such characteristic symptoms that I hardly feel any one is excusable for not recognizing it, even in the early stages. In most cases I think the process in the upper air tract will go on with only slight temperature; in three or four days we have a sudden access of temperature, and following that a septic wave. Now it is your place as an operator to think of one thing, and that is the possibility of lung abscess. We may, and frequently do have pain in the lung, a sharp, lancinating pain. Then we have a cough, a paroxysmal cough, which is very severe at times. Then we have another thing, which is a very characteristic symptom, and it is your place to elicit it from your patient if he does not tell you. Every time he coughs he notices a very fetid odor. That is enough. Why wait longer? In a few days you will have excessive expectoration and offensive sputum. If you go over that chest and use your ordinary clinical sense, you will demonstrate an area in one or both lungs that is diseased. You do not have to wait for hemorrhage. You do not need to wait until your patient's temperature is 105° or 106°. Now is the time, if you have not done it before, to have your radiograph made. The whole picture is clear, and no one should make any error; there is no excuse for error. You have the primary cause, you have the tragic line of symptoms following, and in your physical diagnosis you can make out the changes in the chest cavity. All this can be done in the first week.

Another point. I do not deny that Doctor Lynah in his work is wonderful. It clears up diagnosis when they have failed to be made. It localizes the abscess. But it has already become chronic by this time, and no man should let it go that far.

As to treatment, when recognized early, unless it is a multiple abscess in which the whole septic character of the condition is ap-

parent, there is no line of treatment that offers absolutely so complete success as artificial pneumothorax. I say that, knowing from personal knowledge just what I am saying. It is really extraordinary to see in a case of lung abscess, after the first injection of 200 c. c. of air into the pleural cavity, the marvellous change in the patient, the sudden drop of temperature. One must be careful in the amount of air injected into the pleural cavity. It must be carried on cautiously, but it gives such wonderfully good results without any inconvenience to the patient, who continuously improves from the time of the first injection of air. The treatment which Doctor Lynah gives, and which was seconded by Doctor Forbes, is no doubt an invaluable aid in the chronic type of cases, and it may be of value in acute cases; but I am certain that artificial pneumothorax is the ideal treatment for this type of cases.

DR. RICHMOND MCKINNEY (closing): Dr. Jackson spoke of the treatment of laryngeal papillomata. I have had good results in several of these cases where removal was practiced through the Jackson speculum, without anesthesia. I have had five cases of papillomata in children in which I used this method, with no return. Even if it becomes necessary to repeat this procedure, it is a simple and easy method. There is no pain and absolutely no danger, it is much better than doing a tracheotomy, and you get just as good or better results.

Dr. Forbes spoke of the vague history in some of these cases of foreign body in the lung. That is true, especially in influenza, where the edema sometimes makes us think we have a foreign body. But there are ways in which this can be diagnosed. There is no special danger in bronchoscopy, so why not use it more for diagnosis in all of these cases where there is the least element of doubt as to the presence of a foreign body?

## RECENT OBSERVATIONS ON LARYNGO-PULMONARY TUBERCULOSIS.

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We all realize how difficult it is to render an accurate prognosis in laryngo-pulmonary tuberculosis. The average length of life of a patient suffering from laryngo-pulmonary tuberculosis has been estimated by various men to be from two to four years. Although this may be a fact, to the individual patient it means very little, for we all know that some cases of laryngo-pulmonary tuberculosis live but a few weeks, while others enjoy good health for many years. The individual affected is not particularly interested in the average length of life, but he does want to know how long *he* may expect to live. In order to arrive at a fairly accurate prognosis, it behooves us to study each case by itself, and even then we may expect to err occasionally.

It is generally understood that laryngeal involvement renders the prognosis very serious. Older writers have been of the opinion that laryngeal involvement rendered the prognosis absolutely hopeless. My personal observations are at great variance from the generally accepted opinion, and it is my present purpose to bring forth some of my observations, based on nearly ten years experience with tuberculosis of the lungs and of the larynx.

While on the staff of the New York City Sanatorium at Otisville, New York, from 1913 to 1918, I observed a large number of patients with laryngeal tuberculosis, some of whom lived only a short time while others lived and enjoyed good health for years, in spite of the fact that their lesions were quite extensive. This puzzled me very much, and therefore I examined a large group of patients, carefully noticing the pathologic manifestations. I also observed these patients for a long period, making careful record of the course of the disease in the larynx. From these observations I became convinced that laryngeal tuberculosis was either peracute, acute, subacute, or chronic. These various forms have already been discussed by me in previous works, but because of the intimate bearing on the subject I will describe them again.

THE PERACUTE cases of laryngeal tuberculosis, fortunately, are infrequent compared with any of the other forms. These cases are very rarely seen in the stage of edema, but usually present extensive ulceration and perichondritis. They are often accom-

panied by tuberculosis of the faucial tonsils and soft palate. Dysphagia and aphonia are always present, especially when the pharynx is involved. Emaciation is rapid, the patient is febrile and soon becomes moribund. Other organs of the body such as the intestines and meninges are often also involved. The peracute type usually begins as such, although occasionally it follows the acute type.

THE ACUTE TYPE is characterized by a soft edema of the larynx with a tendency to ulceration. It may begin as such, or it may follow the subacute or chronic type. It usually occurs in the advanced cases of pulmonary tuberculosis, often in moderately advanced cases, and occasionally in incipient cases. There is little or no tendency to fibrosis. Nodules consisting of tubercles can often be seen projecting above the surface of the mucosa. When the tubercles caseate, they give rise to ulcers. During the stage of caseation the nodules often coalesce, with the production of extensive ulceration. The patient usually suffers from marked hoarseness or aphonia, a sensation of fullness in the throat, and irritation with a constant desire to expectorate. Dysphagia is of common occurrence and may be very pronounced, depending on the location and character of the ulcerations.

THE SUBACUTE TYPE is characterized by a semiedema of a part or parts of the larynx with a moderate tendency to fibrosis. It may begin as such or else follow the acute or chronic type. It takes a subacute course, has a tendency to healing, and is usually benefited by treatment. Lesions with papilliform infiltrates and soft polypoid excrescences generally belong to this type. The local symptoms may be slight or moderate, depending largely on the site and the extent of the lesion. Hoarseness, as a rule, is present, particularly when the true vocal cords or the interarytenoid sulcus is involved. Dryness of the larynx is generally complained of, and more so when the fibrosis is extensive.

THE CHRONIC TYPE offers the best outlook, and is characterized by firm infiltration of a part or parts, with a marked tendency to fibrosis and healing. The lesion, due to an extensive proliferation of connective tissue cells, is usually limited in extent to the affected areas, and may remain so for an indefinite period. These patients suffer very little, and often, with the exception of occasional dryness in the larynx and slight hoarseness, have no symptoms at all. For this reason this type is very often overlooked.

In rendering a prognosis in laryngo-pulmonary tuberculosis, although all other factors, such as character and extent of the

pulmonary lesion, the general condition and mental condition, early diagnosis, etc., should be considered, the chief determining factor is the character of the laryngeal lesion itself. For it often happens that a patient will be given a good prognosis based on his pulmonary lesion, only to have the prognosis changed when it is discovered that he suffers from an acute involvement of the larynx as well.

The summary of my observations on the prognosis in laryngo-pulmonary tuberculosis, therefore, is as follows:

In peracute cases, with or without involvement of the pharynx and regardless of the pulmonary lesion, the prognosis is bad, and the life of the patient is from a few weeks to a few months. Here as a rule, the patient dies from an overwhelming toxemia and from inanition caused by dysphagia. Local treatment is of no avail and is not indicated except for the relief of pain. Our aim should be to make the patient as comfortable as possible.

Acute cases often improve under skillful treatment, and when the pharynx does not show microscopic involvement and the pulmonary and general conditions are at all favorable, the prognosis is not hopeless. These patients should be kept under a careful regimen and persistently treated generally and locally. They often improve and occasionally become completely cured.

The subacute cases present a good outlook, and the prognosis depends a great deal on the pulmonary lesion and timely treatment. With good general care and with proper local treatment, the laryngeal lesion becomes fibrosed and chronic.

The chronic cases present the best outlook. Patients with this type of lesion usually get along best under general treatment alone. The prognosis as to life is hardly ever influenced by chronic laryngeal tuberculosis, and therefore in rendering a prognosis in these cases the larynx may be entirely disregarded.

I shall now illustrate my paper by citing to you a few cases of the different types of laryngeal tuberculosis:

#### CASE RECORDS.

No. 1. Mrs. R. G., age 20. Patient consulted me on account of slight hoarseness and dysphagia. Examination revealed early pulmonary tuberculosis somewhat active. Larynx showed edema of epiglottis and both vocal cords, and a semiedema of both arytenoids. Patient also gave a history of a six months pregnancy. General and local treatment were instituted but apparently without result. Dysphagia became worse and emaciation progressed. About two weeks later both tonsils revealed

the presence of microscopic tubercles, and gradually the soft palate and uvula became involved. The disease progressed rapidly and patient died about twelve weeks from the time I first saw her, giving premature birth two days before death.

Diagnosis: Peracute tuberculous laryngitis with involvement of tonsils and soft palate.

No. 2. R. M., age 36. Pulmonary lesion advanced and active with bilateral involvement. Larynx showed very acute edema of epiglottis, arytenoids and aryepiglottidean folds. Patient has a great deal of dysphagia and suffers from complete aphonia. Local treatment has been attempted but with no results.

Diagnosis: Peracute tuberculous laryngitis; prognosis, very bad.

No. 3. E. N., age 23. Patient was referred to me by Doctor Thomas R. French, of Brooklyn, New York, in February, 1921. First examination revealed that he suffered from advanced pulmonary tuberculosis with activity. He ran an afternoon fever of  $101^{\circ}$ - $102^{\circ}$ ; was considerably emaciated and suffered from loss of appetite. Examination of larynx showed acute edema of epiglottis with angry looking ulceration of right side. Rest of larynx seemed quite free. Dysphagia was pronounced. Patient was put to bed where he was kept for about four months, and larynx was treated locally. Examination in early part of September showed that the pulmonary lesion was quiescent; temperature was normal; patient gained about five kilograms in weight; ulcer of epiglottis was completely healed, with some loss of tissue and formation of scar; dysphagia completely relieved and patient allowed to return to work.

Diagnosis: Acute tuberculosis of larynx, healing by fibrosis.

No. 4. M. H., age 30. Referred to me by Doctor V. G. Bourke, of Livingston Manor, New York. First examined February 2d, 1921, when her condition was as follows: Pulmonary lesion far advanced and moderately active; sputum positive. Larynx revealed inflammation and uniform infiltration of epiglottis with ulceration; infiltration with erosion of both aryepiglottidean folds; edema in the posterior commissure and pear shaped swelling with ulceration of both arytenoids. There was also an acute infiltration of the posterior ends of both vocal cords. Patient ran a fever in the P. M. and suffered from great dysphagia and aphonia. The laryngeal lesion was apparently of the acute type. General treatment was instituted and in addition to vocal rest, the patient was treated with topical applica-

tions of iodine solution. On October 5th, 1921, patient showed general improvement; pulmonary lesion was considerably more quiescent; examination of the larynx showed the epiglottis only very slightly edematous, and on a casual examination it might even be considered normal; the arytenoids showed only a slight thickening with healing ulceration. All the edema observed eight months ago was practically gone. No dysphagia, and patient now has a pleasant low pitched voice.

Diagnosis: Acute tuberculosis of the larynx, gradually healing by fibrosis.

No. 5. J. F., age 24, is a case of far advanced pulmonary tuberculosis with positive sputum; marked hoarseness. Examination revealed extensive infiltration of both cords, with large papillomatous mass in posterior commissure, interfering with complete approximation of cords. Diagnosis was subacute tuberculosis of the larynx. Patient has been treated locally with topical application of iodine solution in increasing strengths, and is showing steady improvement in voice.

No. 6. L. R. Patient has a moderately involved pulmonary lesion with positive sputum. Examination of larynx shows a papillomatous growth in the posterior commissure which has been stationary for over a year. He is practically free from symptoms, except for occasional discomfort and feeling of irritation in larynx. Such a lesion practically never influences the prognosis.

Diagnosis: Chronic tuberculous laryngitis, with a good prognosis.

No. 7. M. F., age 19. Referred to me by Doctor Thomas R. French, of Brooklyn, New York. First examined on March 12th, 1921. Findings were as follows: Pulmonary lesion incipient and inactive; sputum positive; examination of larynx showed a warty growth of epiglottis and a general hyperplasia of the mucous membrane of the entire larynx, with thickening of the arytenoid cartilages; a small portion of the rim of the epiglottis was recently excised for diagnosis, leaving a large slowly granulating ulcer. Patient suffered from much dysphagia. The patient, in addition to general treatment, was also treated by local applications of iodine solution, and on September 2d, the examination showed the epiglottis much diminished in size and edema generally lessened. The entire larynx showed distinct improvement with complete relief from dysphagia.

Diagnosis: Lupus of larynx, gradually healing.

No. 8. J. C., age 38. Admitted to the Otisville Sanatorium in 1913, and was found to have a moderately advanced pulmonary

lesion with a positive sputum. Wassermann negative. Larynx showed a tuberculoma of the interarytenoid space with healed erosion, thickening and infiltration of both cords, especially the left. Left cord also showed healed ulceration on its upper surface. Infiltration of both ventricular bands, especially the right, which almost entirely covered the right cord. Lesion showed complete fibrosis, and outside of marked hoarseness, patient had no discomfort. The diagnosis was chronic tuberculosis of the larynx.

Examination of the larynx three and one-half years later showed the findings to be identically the same. In the meantime, the patient has been doing very well, and shows no signs or symptoms of decline. The probable duration of the lesion according to the patient's history is about ten years. The patient does not receive any local treatment.

I have not seen this patient in the past four years, but in answer to an inquiry from me, received last week, he states that he works, has gained some weight, and feels as well as ever. His voice is still husky, but with the exception of occasional irritation in the throat he does not experience any troublesome symptoms.

No. 9. I. T., age 20. Admitted to the Otisville Sanatorium on December 20th, 1916. Chest examination revealed a moderately advanced lesion of the lungs. On the third day at the sanatorium, the patient developed a slight afternoon fever, which afterwards became persistent, rising to  $101^{\circ}$ - $102^{\circ}$  F. on every afternoon, while the pulse ranged between 110 and 130 during his entire stay at the sanatorium. The examination of the larynx, on admission, showed a uniform infiltration of the epiglottis with slight thickening at the posterior commissure and arytenoids. On January 5th the patient complained of slight dysphagia, and the examination showed the beginning of tuberculous infiltration of the oropharynx which kept getting more extensive, while the symptoms were gradually becoming more troublesome. On February 1st, the patient complained of severe dysphagia and regurgitation of liquid food through the nostrils. He then showed extensive infiltration and ulceration of the oropharynx and fauces. Uvula was edematous. Larynx showed edema of epiglottis and both arytenoids, and the Wassermann test was negative.

On February 14th, 1917, the lesion was widespread. Uvula was much swollen and covered with macroscopic tubercles. The lingual tonsils were also ulcerated. The larynx showed acute edema with macroscopic tubercles of all parts. All during his

stay at the sanatorium, the patient received local applications of solution of iodine to the affected parts, with no apparent benefit. On February 15th the patient was transferred to a city hospital, where he died a few days later.

This is a typical case of the peracute type and the prognosis is extremely grave.

No. 10. C. B., age 20. Pulmonary lesion moderately advanced with positive sputum. Laryngoscopic examination showed infiltration with superficial ulceration of the epiglottis; also infiltration with ulceration of both true cords, ventricular bands and arytenoids. There was also marked interarytenoid hyperplasia with ulceration. Patient suffered from extreme hoarseness and sense of fullness in the larynx, but there was no dysphagia.

After seven months of treatment the edema has almost entirely disappeared; ulcerations, with the exception of those in the posterior commissure, are all healed. There was marked improvement in phonation, and the lesion showed steady healing by fibrosis.

The same patient was seen by me recently, about seven years after my first examination. The appearance of the larynx is about the same as described after seven months of treatment; the epiglottis is absolutely free from involvement; the patient is still somewhat hoarse, but, generally, seems to be in fairly good condition.

Diagnosis: Acute tuberculosis of the larynx which is gradually healing by fibrosis.

#### DISCUSSION.

DR. JAMES J. KING, New York City: I have known of Doctor Dworetzky's work along this line for nearly ten years. He is to be congratulated upon the classification he has made of the various lesions in laryngeal tuberculosis, and I think he is to be congratulated also upon the results he gets from the care and treatment he gives these patients. I have no word to add, except one of commendation for his careful work. In these cases, however, it is well to look into the sinuses, the teeth and tonsils, and along with the other treatment clear up the focal infections of the head. I have seen a good many with tuberculosis who have been benefited by this additional treatment. That is the only point I wish to add to the paper.

DR. FRANK L. DENNIS, Colorado Springs, Colorado: I wish to join with Doctor King in adding a word of commendation and appreciation of Doctor Dworetzky's paper.

It seems to me the situation with regard to laryngeal tuberculosis has been twofold. On the one hand there have been the men who

say, "Let them alone," and on the other hand we have perhaps some who have been inclined to do too much in these cases.

The first point I wish to emphasize is the individualizing of these cases in treatment and in classification. I think it is distinctly the thing to do and makes for success.

Another point I wish to speak of is the persistence in both general and local treatment. I think there is a great interdependence between the condition of the lungs and that of the larynx. But the main point is that these cases should be classified and treated where treatment is required. As Doctor Dworetzky said, there is no specific treatment for laryngeal tuberculosis. No man can say it can be treated in any particular way; but the cases should be individualized and so treated.

The case the doctor showed of the ulcerated epiglottis illustrates the point, that some of these cases are very amenable to treatment and get well. I have seen almost the entire epiglottis ulcerate and be lost, and finally get well.

We laryngologists do not as a rule handle the patients generally, but I think perhaps something may be said for that. The throat man's attention is directed more to the throat, but the throat man and the general man working together can get better results than either one trying to work alone.

DR. THOMAS E. CARMODY, Denver, Colorado: I wish to compliment Doctor Dworetzky on his paper and his slides. I also wish to emphasize what Doctor King has said, that we should get rid of any focal infection that we have aside from the lung and larynx.

As to the percentage of involvement, that depends upon what we call laryngeal tuberculosis. If you take cases that simply show hyperemia of the larynx, you will find 95 percent. of cases show that. But the percentage of cases with infiltration and ulceration is very low.

As to carrying out the treatment, I have no suggestion to make, except that he did not refer particularly to rest. We prescribe rest in pulmonary tuberculosis, and I see no reason why it should not be done in laryngeal tuberculosis. We find that many of these cases will not need to be treated locally if you silence them. I do not mean telling them to whisper. That sometimes will cause more trouble than to talk in a loud voice. The force with which the air is brought through the larynx sometimes will cause a great deal of trouble.

We used to operate a great deal for removal of the epiglottis, both by cutting it away and by using the cautery. To-day we do that less and less, although there are some cases where we feel the cautery is of value. A few years ago we treated a great many cases in the office; but to-day we feel that the harm done the patient by coming to the office is more than the good secured from office treatment. Now most of the cases are simply kept in the sanatorium and taken to the nose and throat department for treatment.

DR. JULIUS DWORETZKY, Liberty, N. Y. (closing): Regarding vocal rest in laryngeal tuberculosis, I consider it very, very important. I am sorry that I did not say something about it. The way I apply it is by individualizing my patients first. If it is a peracute case, the patient usually suffers from aphonia and cannot speak. In the acute cases we insist that they rest their voice, and also in the subacute cases. In the

chronic cases we usually allow the use of the voice. The principles applying to the treatment of laryngeal tuberculosis should be the same as in pulmonary tuberculosis. If you had a case of chronic pulmonary tuberculosis you would not put him to bed and keep him there at absolute rest; you would let him exercise some. The same principles should be applied to the treatment of laryngeal tuberculosis.

## ACUTE INFECTIONS INTO THE SEBACEOUS GLANDS AND HAIR FOLLICLES OF THE NASAL VESTIBULE.

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That the common and usually trivial boil in the nose can suddenly terminate fatally by extension of the infection through the venous channels to the cavernous sinus, is not realized by the laity and not, I fear, any too well recognized by many physicians. When only two text books on Rhinology mention furuncles and do not hint, even, that there might be grave complications, and also, when only a few text books on General Surgery mention the subject, it is no wonder that this condition is considered so lightly. One striking fact in the literature is, that most of the cases are recognized only when they are well advanced and hopeless, this usually by the consultant who reports the case.

If anything is to be done to cut down this mortality, it will be by early recognition that the cavernous sinus is threatened, and very prompt measures taken to prevent it.

*Etiology.* Predisposing and exciting, same as furuncles elsewhere on the skin, plus bad habits of picking nose and pulling out the vibrissae, and infection from nose passing through vestibule. The staphylococcus is the common organism, but it may be the streptococcus.

*Symptoms.* Pain, tenderness, redness and circumscribed swelling in vestibule, sometimes showing through to the external skin. Later, softening at center with rupture and discharge of pus and slough "core" followed by prompt healing.

This trivial discomfort may suddenly become extremely serious by extension to the cavernous sinus.

This may be due either to attempts at opening, usually with a dirty needle at home, or by squeezing and rupturing Nature's barrier, driving the infection into the less resistant subcutaneous tissue, or to picking the head off the furuncle with a dirty finger nail, or to too free incision, opening up new avenues outside of Nature's barrier. In other cases, it seems to have traveled the venous channels by what we term lack of resistance to infection.

*Diagnosis.* A furuncle or collection of them should offer no difficulty; in fact, the patient usually has correctly diagnosed his red, swollen, painful nose as a boil, and usually has operated with a needle and squeezed same before seeking medical aid because it is getting worse under his treatment.

*Complications.* There may be sloughing of the inferior lateral cartilages.

The cavernous sinus may become infected more frequently than is generally thought, and it is one's duty to forestall this calamity, if possible, for as you know, the mortality of cavernous sinus thrombosis is practically 100 per cent.

It behooves us to manage the case so that the infection will not reach the sinus, if it can be avoided.

Seeking light from the literature, one feature of nearly all the reports is that the cases were not seen until too late and diagnosis made still later. Also, the vestibular furunculosis is not well classified, cases being found in with other case reports. Also, when and how the primary focus was handled is not clear enough to draw any constructive deductions, whether the cavernous sinus thrombosis came from either neglect or mismanagement, or was so fulminating that nothing could be done.

With a vestibular infection, a tentative diagnosis of cavernous sinus thrombosis should be made on the appearance of any of the following eye or orbital signs which should be considered very suspicious: swelling of the lids, chemosis, pupillary changes, deep seated headache, beginning ptosis and exophthalmos, lacrimation, congested retinal veins, symptoms of sepsis. Later, when ophthalmoplegia, pronounced chemosis, edema of the lids, and exophthalmos plus cerebral and septic symptoms develop, the case is hopeless and it usually is only a matter of a few hours before the opposite eye indicates that both cavernous sinuses are thrombosed, and that dissolution is near.

*Treatment.* Though most of the vestibular furuncles are trivial affairs, it should ever be remembered that, from poor resistance of the patient or bad management, a seemingly trivial affair may explode with fatal results.

When fortunate to be seen early, my procedure is to use wet dressings inside and out; as soon as there is evidence of pointing, to make a small incision at this place and never to go outside of Nature's barrier. By applying suction I draw out the infective material, and then fill the cavity with bis-

muth paste between treatments, never squeezing the swelling for fear of causing rupture into the subcuticular tissue, where the chances of tissue resistance are much lower. This treatment seems to be much better than extensive incision and expression, which is often mentioned in the literature of the cases which later developed cavernous sinus thrombosis.

I have treated a number of cases in which the local involvement was severe, yet with a small incision entirely within the barrier and suction, they have recovered without complication, except sloughing of the inferior lateral cartilage in three cases.

As this infection extends along the anterior facial, angular and superior ophthalmic veins to the cavernous sinus above, and perhaps by the deep facial vein and pterygoid plexus below, it seems rational to ligate the anterior facial vein near the inner canthus, as Bullock<sup>1,2</sup> reports in one successful case of upper lip infection, and also to ligate the anterior facial above the deep facial vein, at the anterior border of the masseter muscles, the minute you feel that the infective area is increasing instead of diminishing, or if there is the slightest orbital or ocular symptoms of cavernous involvement.

As lateral sinus thrombosis sometimes recovers, similarly why may not the cavernous sinus overcome a slight infection, if further supply is stopped? At least, facial vein ligation is a simple procedure and may save the patient's life.

As surgical attack of the cavernous sinus to date for anterior infections has failed to cure,<sup>3,4,5,6,7,8</sup> it has in a few instances even failed to open the sinus, but further technical experience and earlier diagnosis will probably produce better results in a present hopeless situation by one of the different methods.

#### BIBLIOGRAPHY.

1. Bullock, W. O. Upper Lip Cellulitis. Excision of Necrotic Areas. Ligation of Both Facial Veins 3/4 Inch Below Inner Canthus. Recovery. *Surg. Gyn. and Obst.* Vol. xiv, No. 2, 1912, p. 156.
2. Sehileau. Upper Lip Cellulitis. Resection Anterior Facial Vein. Recovery. *Soc. de Chir.*, 6 fr., 1910, p. 123.
3. Dwight and Germain. *Boston Med. and Surg. Jour.* Vol. cxlv No. 18, pp. 456-461, May 1, 1902. Extensive bibliography.
4. Voss. *Central. für Chirurgie*, 47, Nov. 1902.
5. Luc, H. *Bull. et Memoir de la Soc. Fr. d'Ot., de Lary. et de Rh.* Congress 1905.
6. Ballance, Hobhouse. *Ann. Otol. Rh. and Laryn.* xxi, 924, Dec. 1912. References.
7. Mosher, H. B. *Laryn.* Aug. 1914.

8. Langworthy, H. G. *Ann. Otol. Rh. and Laryn.*, Vol. xxv, Sept. 1916 p. 554. Extensive bibliography.
9. Paget. *Med. Times and Gaz.*, 2, 195, 1862.
10. Nadaud, P. P. L. *Paris Thesis*, 1864.
11. Rau, J. *Jena*, Pohle, 1892.
12. Martin H. H. (Savannah). *Thrombosis of the Cavernous Sinus. Ophthalmology*, Vol. viii, No. 2, Jan. 1912, p. 183.
13. Bryan, J. H. *Ann. Ot. Rh. and Laryn.*, Vol. xxv, Sept. 1916, p. 618.
14. Smith, Dorland. *Arch. of Ophth.*, Vol. xlvii, No. 5, 1918. *Bibliography*.
15. Chisolm and Wilkins. *Arch. Surg.*, 1. 483. Nov. 1920.
16. Jessner, S. *Lehrbuch der Haut und Geschlechtsleiden*. Vol. 1, 5th Ed., 1920.
17. Rodger, T. Ritchie. *Jour. Lary. and Otol.*, 36. 169, April, 1921.

### DISCUSSION.

DR. HAROLD HAYS, New York City: As Doctor Hurd said, it is rather a trivial subject, but sometimes it becomes an exceedingly important one. I am very happy to say that I have never seen a case of cavernous sinus thrombosis following an infection of this kind, although I have read of a great many.

I think his paper is important, first, in that he has brought this matter to our attention; and second, that he has shown us the possibility of treating a cavernous sinus thrombosis by ligation of the facial veins. We are too apt, with patients who have recurrent furuncles of the nose, to give them some simple preparation like mercurial ointment and think we have done all that is necessary.

Most of these cases come within three classes. First, simple irritation of the hair follicles; second, the penetration below the follicles into the deeper layer of the skin with the formation of pus; and third, those cases which go to abscess formation, with all the customary complications. In the majority of cases it seems to me the most important thing to do is to see that all the hairs around the vestibule of the nose are properly cut, and then by using some solution, soften the secretions around the furuncle, and thus be able to get hold of the hair that is penetrating, the same as we get rid of a sty on the eyelid. In the secondary stage it is necessary to go deeper and penetrate the abscess with a probe.

Doctor Hurd spoke about the massage of these parts, and the possibility of extending the infection in this way. It seems to me that if the parts are massaged carefully from the outside, while we inspect the inside of the nose at the same time, we should be able to express a great deal of pus without doing any harm.

I think one of the most important things is to advise the patient about putting applications on the outside of the nose. If severe infection takes place, it is apt to penetrate to the outside of the face instead of through the nose and result in scar. I have had only one instance where it was necessary to do a deep incision into the abscess, and in that case suction was of great benefit, following the swabbing of the cavity with carbolic acid followed by alcohol.

I think the most important part of his paper is bringing to our attention the possibility of handling the infection by ligation of the facial veins.

## ACOUSTIC NEUROMAS.

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The question of acoustic neuroma is so vast that Dr. Harvey Cushing has written a book upon the subject. The case which I am reporting is of a bilateral acoustic neuroma, of which there have been only twenty-four (24) reported in the literature.

Acoustic neuroma constitute 7.3 of all verified tumors of the brain in Cushing's series, and out of sixty cerebello-pontile angle tumors, he found forty-seven of them to be tumors of the eighth cranial nerve. The otologist is the first to be consulted, because progressive unilateral deafness of a definite entity is the chief complaint of these patients, and upon us depends the early diagnosis. If they are to wait until general intracranial symptoms have developed before a diagnosis is made, valuable time will be lost. The neurologic surgeon is prepared to cope with an acoustic neuroma, and when given a case early can remove the tumor with a restoration of the patient's usefulness.

Inasmuch as loss of vision follows the loss of hearing, and is an indicator of increasing intracranial pressure, a tentative diagnosis of an acoustic neuroma may be made on the following facts: First—progressive unilateral nerve deafness until no response may be obtained by the forks either through air or bone conduction. Second—progressive recession of vision with choked disc. Third—failure to obtain a reaction of the vestibular branch with the Bárány tests. Vomiting, staggering, positive Romberg sign and headache constitute late symptoms, and if waited upon before reaching a diagnosis, little can be expected by surgical procedures. No one has ventured to operate before obtaining the first two of the above, and with the assurance of the third, localization is definite enough to justify an exploration of the cerebello-pontile angle.

The following is unusual in that there was a bilateral deafness, though it started unilaterally on the left. After the Bárány tests failed to get through any stimulation and all reaction failed, a diagnosis was made of a tumor in the mid-

brain, which was involving the eighth nerves at their decussation, either directly or by pressure. At autopsy we found a tumor springing from each auditory nerve, and eight smaller tumors scattered over the brain. Prior to death, the patient was totally deaf and could distinguish only moving objects, but had developed a system of palmagraph, whereby her mother wrote upon her palm the necessary information and she would answer by spoken voice.

Miss O. M. Age 20. Referred by Dr. B. F. Turner for a neurootologic examination.

FAMILY HISTORY. Father, mother, one brother, and one sister alive and well. No history of tuberculosis, epilepsy, tumor or insanity.

PAST HISTORY. Normal birth, and progressed naturally until 1915, when she had an acute illness complicated by a right wrist and ankle drop, which was probably an anterior poliomyelitis. During the summer of 1918 she complained of drowsiness, and spent most of her time in bed, but recovered sufficiently to attend school the following term. An acute infection of influenza interrupted school during January 1919 for one week. The spells of drowsiness returned during the summer of 1919, but again cleared up before school opened.

PRESENT HISTORY. Patient first noticed that the hearing was less acute in the left ear prior to entering college September 1919. This progressed rapidly, and in a month's time the right ear began to grow deaf. The progression was so rapid, that she was required to stop attending the lectures before the end of the first semester. At this time her vision was good, and there was no other symptoms. But the vision became blurred in February 1920, and with the blurring she developed an occipital headache.

CHIEF COMPLAINTS. Absolute deafness in both ears, reduced vision, right ankle and wrist drop.

PHYSICAL EXAMINATION. General appearance is that of a well developed and nourished young lady. Mentally alert and answers questions with precision. Head is of normal contour and no scars are present. Eyes (Dr. E. C. Ellett). Pupils are dilated, but equal and react to light and accommodation. Vision O. D. 15/30; O.S. 15/25. There is a choked disc of 2 mm. with normal fields. (Fig. 1). Nares. Postnasal discharge and congested nasal membrane. Tonsils. Were

buried but clean. Ears. The membranae tympanorum were normal. The functional examination showed complete nerve deafness, as she could not hear any of the forks by either air or bone conduction. The Galton whistle could not be heard and the Bárány noise apparatus failed to register. Heart, lungs, and abdominal organs were normal. Extremities: There was a right ankle and wrist drop. Neurologic (Dr. B. F. Turner): Flaccid paralysis with atrophy of the extensors and external rotators of the right forearm. Weakness with atrophy of the peroneal muscles of the right leg. Sensory:

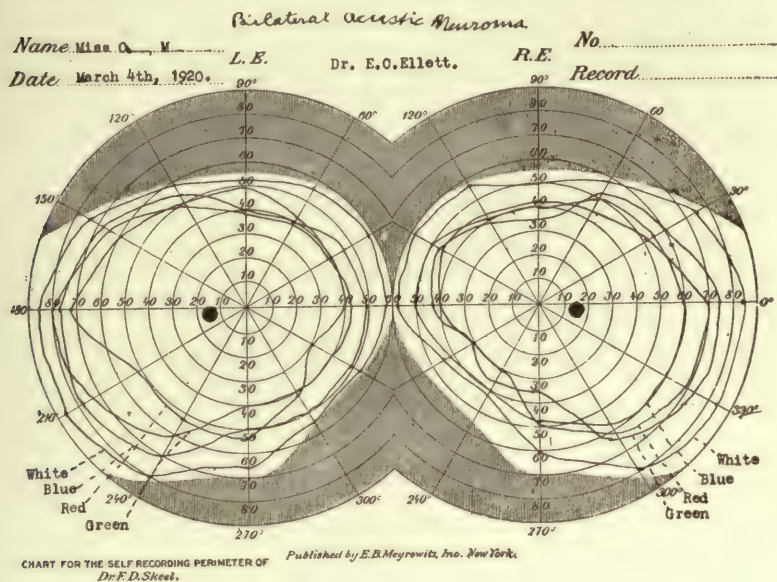


Fig. 1. Normal vision fields.

There are no areas of anesthesia or paresthesia. Reflexes are normal save for wrist and ankle drop.

**BÁRÁNY TESTS.** Summary—Spontaneous was negative. Rotatory—appreciated that she was turning, but had no after nystagmus or vertigo. Caloric failed to produce any reaction. Laboratory Test—Urine and blood were normal. Wassermann was negative on blood and spinal fluid.

**PROGRESS.** March 3. Working diagnosis: Intracranial tumor in the midbrain pressing on the pathways of both nervi acustici. Advised relief of intracranial pressure to save vision.

## BAPTIST MEMORIAL HOSPITAL.

Memphis, Tenn.

## Ear, Nose and Throat Record (2)

Case No. \_\_\_\_\_

Date 3-3-20

Name, O. M. \_\_\_\_\_

Address \_\_\_\_\_

Service of Dr. Shea \_\_\_\_\_

**Labyrinth Cases With Vestibular Involvement.**

Dizziness, none.  
 Staggering, none.  
 Falling, none.  
 Romberg, negative.  
 Tinnitus, none.  
 Deafness, completely and bilateral.

**Tests of the Vestibular Apparatus Spontaneous.****Nystagmus.**

Looking to right, none.  
 Looking to left, none.

**Pointing.**

Shoulder from above, touched.  
 Shoulder from below, touched.  
 Shoulder from side, touched.  
 Right hand had a wrist drop.

**Turning.****Nystagmus.**

To right; amp., none; duration, none.

To left; amp., none; duration, none.

**Pointing.**

To right shoulder from above, touched.  
 To left shoulder from above, touched.

**Caloric.****Nystagmus.**

Douche right; amp., none after 3 min.,

Douche left; amp., none after 5 min.

**Pointing.**

Douche right shoulder from above, touched.  
 Douche left shoulder from above, touched.

**Treatment, Progress.**

Oct. 1, 1920—Spontaneous unchanged. Rotatory was not attempted. Caloric failed to produce a reaction.

March 27th, Dr. R. E. Semmes did a left subtemporal decompression. The dura was tense and the brain bulged. The descending horn of the left lateral ventricle was tapped and fluid escaped under great pressure. A lumbar puncture was necessary to reduce the pressure sufficiently to close the dura.

April 8th. Discharged from the hospital after an uneventful operative recovery with slight improvement of vision, but no improvement of hearing.

October 8th, a second Bárány examination showed no change in the reactions.

October 18th, readmitted to the hospital with vision reduced to light and moving objects. Patient has had an inten-

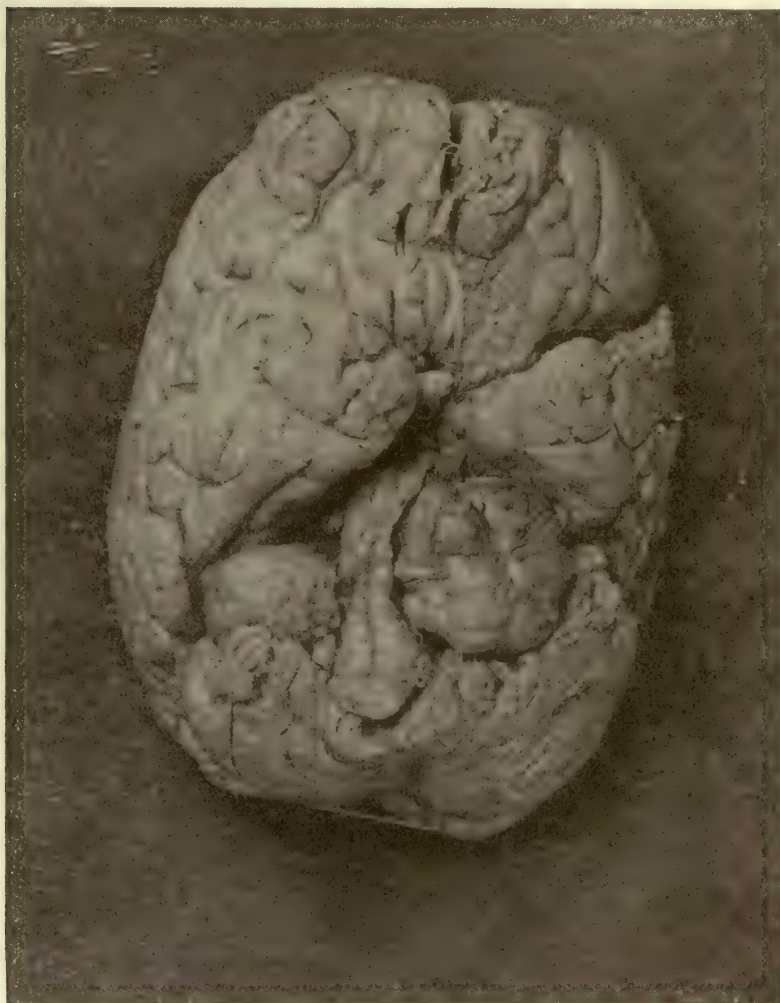


Fig. 2. The tumors have distorted the Pons and Medulla.

sive antisyphilitic treatment. Dr. Semmes injected the ventricles, and the radiogram showed the skull to be very thick, and that there was an internal hydrocephalus. The internal auditory canal was dilated. This decided the question that the tumor was subtentorium, and so on the 20th Dr. Semmes

did a bilateral suboccipital exploration, and uncovered a tumor in the left cerebello-pontile angle. The operation had to be abandoned because the patient went bad, but it was hoped to remove the tumor at a second operation.

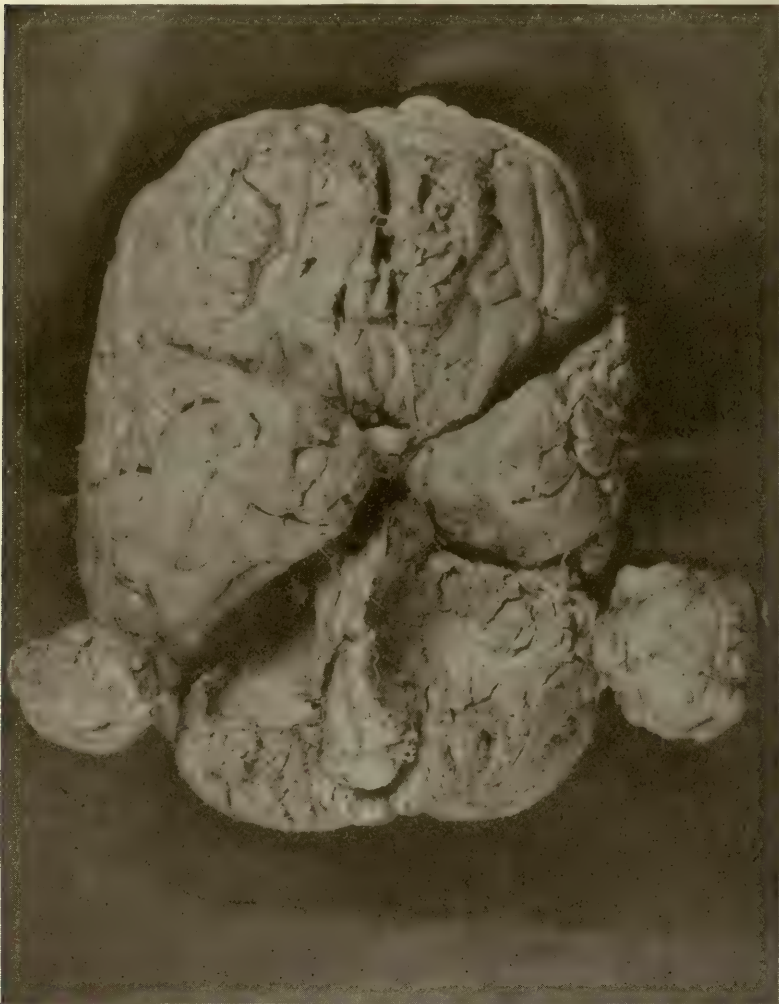


Fig. 3. Shows the tumors out of position.

Oct. 22. Vision improved to recognition of individuals.

Oct. 25. Patient spent the morning on a backrest and was thought to be progressing favorably, but during the afternoon developed a pulmonary edema and died.

AUTOPSY FINDINGS: There was a healed scar in the left

temporal region and a healed "Cross Bow" incision in the suboccipital region.

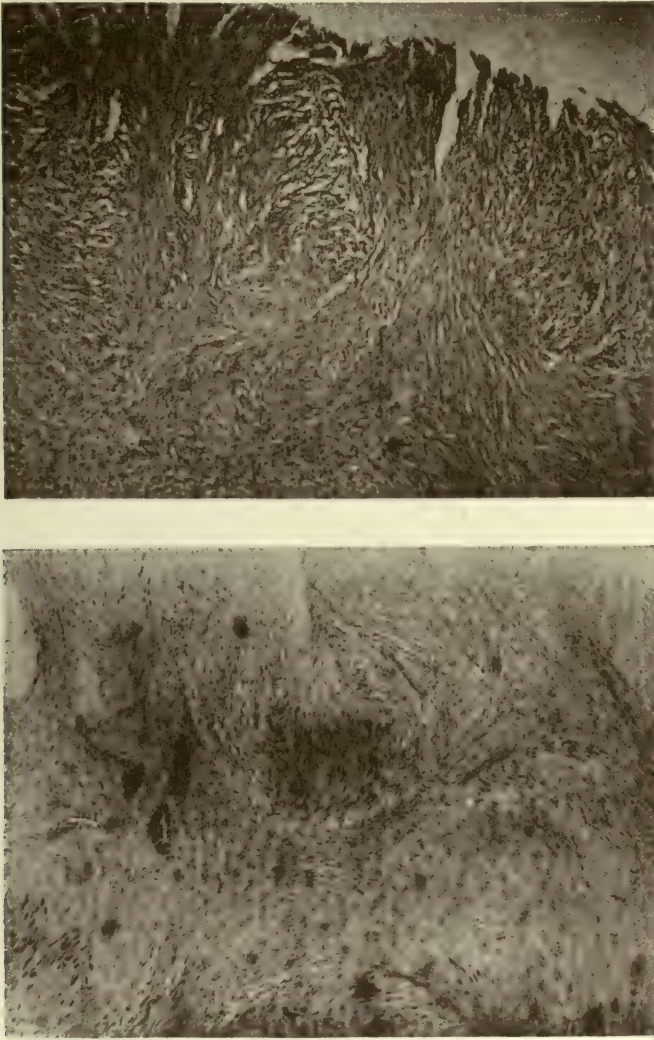


Fig. 4. Low and high power views of the tumor, showing its fibrous nature.

The skull was very thick and dense, and the porus internus enlarged on the left. The dura was studded on its inner surface with small soft opaque white tumors, varying in size from one-fourth to one cm. in diameter. Eight of these caused marked indentations of the cerebral cortex.

There was a hard encapsulated tumor in each cerebello-pontile angle, measuring two and one half cm. in diameter on the right, and three and one half cm. in diameter on the left. The surface was smooth, and the tumor on the left side presented a bossy contour. On the left side there was an elongated bulbous enlargement of the eighth nerve, measuring about one-half by one-fourth cm. (Figs. 2 and 3.)

There was marked compression of the pons and medulla, greater on the left, distortion of the lobes of the cerebrum and cerebellum, and marked herniation of the cerebellum into the foramen magnum.

The third and lateral ventricles were enlarged and the lumen of the infundibulum dilated.

Microscopic examination showed the typical picture characteristic of dural fibromata (neurofibroma). Many of the smaller growths near the superior longitudinal sinus showed calcareous deposits. (Fig. 4.)

Permission for general autopsy not obtained.

**FINDINGS.** Skull very thick. Multiple neurofibromata indenting cerebral cortex. Bilateral cerebello-pontine angle tumor and bulbous enlargement of the left eighth cranial nerve. Internal hydrocephalus (secondary). Compression of pons and medulla and distortion of the lobes of the cerebrum and cerebellum, with herniation of cerebellum into the foramen magnum.

#### BIBLIOGRAPHY.

1. Cushing, Harvey. Tumors of Nervus Acusticus, Saunders, 1917.

#### DISCUSSION.

DR. E. C. ELLETT, Memphis, Tennessee: To those whose experience has been like my own, this paper will teach a valuable lesson. In many years' practice of otology, I had not seen a case of brain tumor whose first symptom was nerve deafness, and until one observes such a case he is not apt to have this in mind as a probable cause. Few cases of nerve deafness ever develop symptoms or run a course that suggests intracranial tumor as a cause.

This case also suggests the necessity of bringing these matters to the attention of those who practice the specialties in which we are interested. The ocular manifestations of intracranial lesions are well known, but in the eye we have not only subjective signs, but certain more or less characteristic objective signs as well.

Supplementing the more usual functional tests of the ear, since there is nothing to be seen, the unusual tests should all be utilized, namely the Bárány tests. It is surprising how much information can be obtained by these tests, properly made and intelligently interpreted, and it is

equally surprising how many of those who should be familiar with their possibilities have no conception of them.

The ocular signs in this case were very meager. You heard the report as to equal and normally active pupils, and saw the normal visual fields. The marked papilledema was sufficiently suggestive, and the absence of other signs indicated, as one possibility, a basal lesion without interference with the optic tract or with any of the cranial nerves going to the eyes or their muscles. As far as the eye symptoms went, one would think of a frontal lobe tumor, but the ear symptoms pointed elsewhere.

We think of bilateral symmetric tumors as capable of explaining certain symptoms, but how seldom do we expect to find such a lesion! As far as my opportunity to examine this case went, the operation seemed to have very little effect on the vision or on the eyegrounds.

DR. JOSEPH C. BECK, Chicago: From my personal experience I would like to briefly mention two cases. One was a unilateral tumor of the acoustic nerve in which many of the symptoms were quite similar to the case reported here; but the point I want to make is that in my case, which terminated fatally on the operating table, death might have been prevented, by getting a clearer history. A decompression was attempted, and on putting the patient in the usual position for suboccipital operation, face down, she seemed to have considerable difficulty in respiration, so much so that we turned the patient on her back, when she breathed regularly again. Turning her over on her face again and working as fast as we could, she developed the labored breathing and in spite of all efforts at resuscitation she died. We gave a fairly good prognosis as to the decompression operation, as we did not see why she should die from such a procedure. We were able to secure a postmortem while the patient was on the operating table, and we found the tumor, as previously diagnosed, was located so close to the fourth ventricle that in changing the position of the patient to face down, something must have occurred to cause her death. In the history neither the neurologist who was consulted, the ophthalmologist who had seen the case, nor in any of our examinations was the information elicited from the patient or anyone else that she would never lie on her face because she was distressed in breathing and her heart would beat very fast. That was stated by the husband after the postmortem. Another point is that the spinal puncture, in tumor cases located as this one, probably causes the sudden death because the tumor sinks against the cardiac or respiratory centers.

The other case is one whose brain I exhibited before the Academy last year, a multiple carcinoma of the brain. This man had four tumors, each larger than a walnut, and five smaller ones, scattered all through both hemispheres as well as the cerebellum. Naturally, there were very many conflicting diagnoses, because whenever another consultant saw the patient he localized the trouble according to the symptoms present at that time. It was interesting to follow the protocol with the specimen and show that each man who examined had located a tumor correctly.

DR. GEORGE F. KEIPER, Lafayette, Indiana: These are naturally rare cases, and when we find them they ought to be brought to postmortem.

I do not know whether in this case the brain was hardened in situ

or not, but Cushing has made this point, that in making tests of this character the brain should be hardened *in situ*, in order that the relationship of the various parts may not be destroyed in removing the brain from the calvarium.

DR. IRVING WILSON VOORHEES, New York City: In 1911, while in Vienna, I was fortunate enough to see Doctor Bárány make his tests in a case which had all the symptoms which Doctor Shea has described. There was total deafness on the left side. A diagnosis was made of tumor of the left acoustic nerve, and the next morning it was planned that Doctor von Iseslberg should remove the tumor. But while the patient was being prepared for operation, he suddenly died of respiratory failure, probably from pressure on the medullary center. At postmortem, the tumor was shown exactly in the location Doctor Bárány had predetermined.

While walking through the tuberculosis ward of one of our New York hospitals, I happened to see a case which had symptoms of intracranial difficulty, but the internist had not made a diagnosis. Although the patient was deaf in the right ear, no special tests had been made. We did a Bárány caloric test—there was no reaction. That is, there was a total loss of function in the right ear. At postmortem, a month later, it was found that the patient had a tumor of the right acoustic nerve. There is no doubt that many of these cases are overlooked as Doctor Shea has said.

DR. EWING W. DAY, Pittsburgh, Pa.: In making a tentative diagnosis of tumor of the midbrain, we may be aided by a knowledge of whether the ventricles are draining or are obstructed by pressure on the aqueduct of Sylvius. A midbrain tumor, situated according to the tentative diagnosis of Doctor Shea, would probably have produced internal hydrocephalus by pressure on this aqueduct.

As a general proposition, the study of the actual cerebral pressure as measured by a manometer has been too much neglected. I have insisted in all my brain cases, that repeated actual pressures measurements be taken, and the variations for five minutes noted. In doing this we use the Straus instrument, having a glass tube 64 cm. long, graduated in mm., so small fluctuations in pressure can be noted. The scale on the mercurial manometer is so fine that these readings cannot be made. Our observations on three cases, verified by postmortems, have led us to believe that obstructed ventricular drainage can be diagnosed by the fluctuations. Observations by others will establish or disprove the accuracy of the method of diagnosis. In a normal draining ventricle, after you have the height of your cerebral fluid, you will notice that at each inspiration and expiration there is a fluctuation of the column; on inspiration the column goes up, and on expiration it falls. If you have an obstructed ventricle that is not draining, or if the tumor is so situated that it is pressing on the aqueduct of Sylvius, when your column has reached its height the column of cerebral fluid in the glass tube will fluctuate very slightly if at all.

DR. ERNEST SACHS, St. Louis, Missouri: There is just one point which from the surgeon's point of view may be of interest, particularly in regard to the localizing diagnosis. I have been working for the last two or three years on the anatomic and physiologic side of the Bárány

tests, and I had been struck prior to that time by the fact that I had seen a number of cases in which the Bárány tests pointed to a pontine lesion, and at operation the only thing we could find was an internal hydrocephalus with no localized tumor. This led us to carry on this investigation.

Briefly, the investigation consisted in making localized lesions in animals in the vestibular branch of the eighth nerve, also lesions in Deiter's nucleus, then tracing out the anatomic pathways to see if we could find the pathways by which the Bárány tests were carried out. The thing that struck me particularly was the fact that the pathways—at least those we were able to verify—all ran near the floor of the aqueduct of Sylvius. This represents a section of the medulla fairly high up, and the section of the pons a little higher up, in the region of the posterior corpora quadrigemina. All these pathways lie close to the aqueduct of Sylvius and in the fourth ventricle. Now it is one of the commonest associations of tumor of the posterior fossa—in fact, I have never seen a case of tumor in the posterior fossa in which there is not an associated internal hydrocephalus, and I believe that every one of the localizing signs of the Bárány tests may be due, not to a localized lesion in the pons, but to an internal hydrocephalus associated with a tumor in the posterior fossa.

DR. JOHN J. SHEA (closing): Doctor Keiper, we were thankful to get an autopsy at all. It was done between twelve and two in the morning, and we did not have time to harden the brain in situ. We tried to preserve the distinct molds of the various parts.

Doctor Voorhees, she had no nausea or vertigo. Apparently the ventricular branches were destroyed at the same time, therefore there was no disturbance of balance or vertigo.

Doctor Day, we did do a test to determine the degree of the hydrocephalus, by doing ventricular tapplings, and ventriculograms.

Doctor Sachs, we thought at first there was pressure from the tumor, but it was from the internal hydrocephalus that we got most of our symptoms.

# A STUDY OF THE SCHWABACH TEST IN ONE HUNDRED CASES.

ROBERT SONNENSCHN, M.D.

CHICAGO.

The study here presented was made on one hundred unselected cases in the University Nose and Throat Clinic of the late lamented Professor Gerber of Koenigsberg, in 1909. These were examined in detail by means of all the usual functional tests. The result of the analysis of the Weber Test (read before the Chicago Laryngological and Otological Society in February, 1911) and of the Rinne Test (accepted as a thesis by the American Laryngological, Rhinological and Otological Society, June, 1921) have already been published, and I will take the liberty of quoting somewhat from these papers. The writer feels that the great importance of the functional testing of the ears warrants the reporting of detailed findings.

Inquiries addressed to prominent European otologists, at the time examination of the cases was in progress, gave the following information regarding the forks employed, and the region of the head on which they were placed. While we are perhaps accustomed to regard the Schwabach Test as made by holding the fork in the midline of the vertex, many of the otologists quoted use the mastoid processes (just as in the Rinne) or the forehead instead of the vertex. In this country, Randall and others employ the Gardner-Brown modification, with the fork at the nasal root and the head bent backward.

Panse (Dresden) employed the  $a^1$  fork (435 v. d.) on the mastoid process; Heiman (Warsaw) uses the weighted C (64 v. d.) and c (128 v. d.) fork, usually on the vertex; Schmiegelow (Copenhagen) uses  $a^1$  (435 v. d.) on the vertex; Urbantschitsch (Vienna) uses C (64 v. d.),  $c^1$  (256 v. d.) and  $c^2$  (512 v. d.) on the mastoids; Hartmann (Berlin) applies c (128 v. d.) on the mastoids; Alexander (Vienna) uses the weighted  $c^1$  (154 v. d.) either on the forehead or the mastoid; Politzer (Vienna) always uses  $c^1$  (256 v. d.) on the mastoid; Moeller (Copenhagen) stated that he used  $a^1$  (435 v. d.) applied to each mastoid; Denker (Erlangen) and Siebenmann (Basel) applied forks A (108 v. d.) and  $a^1$  (435 v. d.) on the vertex; Ucherman (Christiania) used the unweighted  $c^1$  (256

v. d.) on the mastoids; Bruehl (Berlin) uses *c* (128 v. d.) on the vertex; Passow (Berlin) rests *c*<sup>1</sup> (256 v. d.) on the vertex; Kuemmel (Heidelberg) uses *c* (128 v. d.); Lucae (Berlin) employs the weighted *c* (128 v. d.), both placing the fork on the mastoid. Of the fifteen otologists mentioned, we see that eight usually place the fork on the mastoid, six rest the fork on the vertex, and one (Alexander) chooses either vertex or mastoid. This at first seemed surprising, for we were under the impression that most otologists were making the Schwabach by placing the fork in the midline of the vertex, just as in the Weber Test. It then occurred to us that it might be wise to note the relation between the results obtained via vertex, forehead and the mastoid.

The three forks used by us in making the Schwabach Test and also the Weber and Rinne were Edelmann's *A* (108 v. d.); second, the weighted *c*<sup>1</sup> (154 v. d.) [n. b. without weights this fork has the tone of *c*<sup>1</sup> (256 v. d.) but when weighted as used, has the tone of *d* sharp (154 v. d.)]; and, lastly, the small *a*<sup>1</sup> fork (435 v. d.), (v. d. meaning double vibrations as distinguished from single vibrations). The *A* and the weighted *c*<sup>1</sup> forks were excited by allowing them to drop of their own weight and height from a perpendicular to a horizontal position and striking the knee. The *a*<sup>1</sup> fork was held at right angles to the body with the flat surface of the prong uppermost, and a small pleximeter, such as is used by neurologists for testing the patellar reflex, was allowed to drop of its own weight and height from a perpendicular position directly down upon the flat surface of the prong, thus giving a uniform excitation of the fork in all cases.

Schwabach found in conduction impairment due to diseases of the external and middle ear, that a tuning fork applied to the bones of the head was heard longer than normal, and that in cases of auditory nerve affection, the perception of the fork was diminished. For this observation Schwabach advances no physical basis, but Steinbrugge believes that the difference in the perception time for the tuning fork sounds in air and bone conduction is probably due both to impairment within the region of sound conduction (including the labyrinthine part), and to the increased, normal, or diminished irritability of the nerve. In our own tests, in order to make them more objective, the average duration of vibration of the forks employed was determined by examining quite a number of normal cases. Then the difference between

these figures and the ones obtained by testing other cases showed whether lengthened or shortened bone conduction was present.

In many text-books the rule is laid down, that this test is to be made by holding the fork on the examiner's head (when prolonged bone conduction is suspected) when no longer heard, placing it on the patient's head and noting the difference in time. If shortened bone conduction is suspected, the fork is first placed on the patient's head and when no longer heard, applied to the examiner's head and the difference in time again noted. Of course this method can be used only when the examiner has determined that his own bone conduction is normal. We, however, as aforesaid, have used the more objective method.

Even in normal individuals bone conduction varies, depending upon many conditions such as age (at or after middle age bone conduction is considerably diminished), although it may differ in persons of the same age. Other factors are the thickness of the cranial bones, the size of the air spaces, such as the mastoid cells, as well as certain anomalies of the skull, depressions, traumatic changes etc. According to Wanner and Gudden, adhesions between the dura and the bone as well as other traumatic or pathologic changes influence the Schwabach, giving a greatly shortened bone conduction in spite of normal hearing via air. The amount of the hair, the tension of the skin, contact with the auricles and the pressure with which the force is applied, all these may cause variations of the bone conduction. Politzer believes that the Schwabach alone is only in rare instances of great value in differentiating between middle and internal ear disease. When, however, the bone conduction is found prolonged, and the Rinne is decidedly negative, the Schwabach aids in making the diagnosis of interference with the sound conducting apparatus; and where the Schwabach is shortened together with a positive Rinne and impaired hearing, it greatly assists in the diagnosis of an auditory nerve affection. Politzer also states that "as a prognostic sign it is of considerable importance, because cases with lengthened bone conduction are usually more favorable as to their course and the result of treatment than where it is shortened." This dictum, however, we must modify by stating that in typical otosclerosis, where the bone conduction is greatly prolonged, the prognosis in every direction is poor.

Boenninghaus employs a  $c^2$  fork and cautions against using forks much lower than this, as their heavy vibrations cause confusion in the mind of the patient in differentiating between tactile and auditory perceptions. He does the Schwabach by holding the fork against the mastoid in the region of the fossa mastoidea with a firm contact (short of producing pain), and then periodically increasing and lessening the pressure, "thus producing an intermittent stimulation which does not fatigue the ear and at the same time facilitates the determination of the maximum stimulation (*Reizschwelle*)."<sup>1</sup> If the sound is referred to or is said to be heard louder or entirely in the opposite ear, then of course the bone conduction in the examined ear cannot be determined; but indirectly an idea is obtained regarding this ear when the other is examined. If in the second ear the bone conduction is shortened, it is still shorter in the first one; if it is normal in the second ear, it is shortened in the first one; but if it is lengthened in the second ear, it really shows nothing definite about the first ear, which may have a shortened, normal, or even a prolonged bone conduction, although of course not so prolonged as in the second ear. In comparing the patient's bone conduction with that of the examiner, a difference of a few seconds with forks of long vibration time is of no significance. This may be due to several factors, such as unequal pressure in applying the forks as well as placing it on the identical spot on each mastoid; to a difference in the attention on the part of the two individuals; or to variations in the thickness of the bone. One must avoid touching the auricle with the fork, as this causes the former to vibrate and give hearing by air conduction, and thus prevent determination of the moment when the bone conduction ends. (N. b. Boenninghaus: "When bone conduction is neither much prolonged nor decidedly shortened, contact of the fork with the auricle will again cause perception of the tone after it can no longer be heard via mastoid.")

Bezold determines bone conduction at two pitches, employing the A and the  $a^1$  fork (or others near them in the scale). After the forks are vigorously struck, they are placed on the vertex. Since the other ear cannot be excluded completely from hearing, he considers it impracticable to test via mastoid process. "The Weber Test will show in which ear the sound is heard the louder." With conduction apparatus interference, the sound is much more prolonged with A (108

v. d.) than with  $a^1$  (435 v. d.); in fact, it often happens that the Schwabach test carried out with an A fork shows a lengthening of bone conduction, whereas the  $a^1$  fork shows a shortening; in such cases disease of the internal ear is also present. Bezold also calls attention to the fact that slight differences in hearing the fork are of no significance. With the low forks usually employed in the Schwabach test, we must bear in mind the powers of observation and concentration on the part of the patient, and also the many adventitious sounds in our environment resembling those of the forks.

It is Mach's theory that the bone conduction is increased by any disturbance in the external or middle ear, because the normal outward flow of sound is thereby hindered and a second reflection of sound towards the labyrinth produced. This presupposes, first, a direct or regular transmission from bone to inner ear, and secondly, that normally the conduction apparatus transmits sound vibrations as easily outward as inward. The first assumption is not proven; and according to Helmholtz the second theory is untenable, because the lever action of the conducting chain, whose long arm consists of the radiating fibers of the drum membrane, easily transmits inward the slightest changes in air vibration, but cannot by means of the short lever arm, namely, the fibers of the ligamentum annulare, transmit them outward. Weber, Brunner, and Lucae believe that the increase of bone conduction in middle or external ear obstruction is partly due to the resonance of the imprisoned column of air. The presence of fluid on either side of the drum membrane increases the bone conduction, because the fluid is a better medium for transmission of sound from the bone to the membrana tympani than is the air. The theory of resonance produced by the air in the middle ear spaces does not, however, explain the occurrence (so very often noted) of increased bone conduction (negative Rinne), when the middle ear is filled with secretion. Bezold's theory is based on certain physiologic findings and experiments. For the proper sound transmission via air, the conduction apparatus must be in a state of equilibrium, a slight disturbance of which, such as a pure tubal occlusion, is sufficient to produce a decided diminution in air conduction, and an equally definite increase in bone conduction. This equilibrium is likewise affected by large perforations through the drum membrane with a loss of some of the radiating fibers, and resulting overaction of the tensor tympani muscles.

Sclerotic processes in the tympanic cavity may also cause an increased tension in the conduction apparatus. Bezold holds that *bone conduction* is brought about by means of the sound conducting apparatus of the middle ear, and *differs* from air conduction *only* in the fact that with bone conduction the sound waves strike the edge of the drum membrane and the ligamentum annulare, and not the flat surface thereof. By experiment he showed that increased tension in the conducting apparatus and at the same time that of the ligamentum annulare, produced lengthened bone conduction and diminution of air conduction. On this basis he claims to have a simple explanation for the findings of the Weber and Rinne reaction in the majority of cases of the middle ear affection. The increased tension ("anspannung") at any point in the conducting apparatus reduces the ability to transmit air borne sound waves, but heightens its power to conduct vibration via bone to the labyrinthine fluid. Retjo lays emphasis on the role which the round window is supposed to play in bone conduction.

O. Beck and others have called attention to the diminution in bone conduction often noted in cases of lues with otherwise good hearing and no aural symptoms. He says that this lowered bone conduction may be found in 80 per cent of syphilitic subjects, and that it appears mostly in the secondary and only infrequently in the first stage of lues. Goeckermann, Barlow and Stokes found the lowered bone conduction test (diminution in conduction of sound by bone as compared with otherwise normal hearing) positive in 78 per cent of known syphilitics in their series. According to these writers, the tests agree with the positive or negative diagnosis of syphilis in 67 per cent and disagrees in 33 per cent. The test was also positive in 48 per cent in patients in whom syphilis was apparently excluded. They conclude that the diminished bone conduction has only "a restricted value as a diagnostic aid in lues owing to its high factor of error."

BOTH EARS POSITIVE RINNE

Age, History, Diagnosis, etc.	Forks used.	Schwabach		Schwabach	
		Via vertex.	Via forehead.	Right ear.	Left ear.
Case 9. Age 55. M.	A	20	16	20	10
Affectio nervi acustici.	c <sup>1</sup>	14	11	18	16
Tinnitus and poor hearing.	a <sup>1</sup>	0	0	15	14
Case 10. Age 42. F.	A	15	13	30	25
Chr. adhesive process. No sup- puration. Some affectio nervi	c <sup>1</sup>	30	25	40	40
acustici. Poor hearing.	a <sup>1</sup>	10	7	10	9

Age, History, Diagnosis, etc.	Forks used.	—Schwabach—		—Schwabach—	
		Via vertex.	Via forehead.	Via mastoids Right ear.	Left ear.
Case 12. Age 17. F. Rhinitis atrophica. Drums nor- mal. No ear symptoms.	A c <sup>1</sup> a <sup>1</sup>	60 55 15	45 40 5	80 70 35	100 90 45
Case 13. Age 21. F. Ot. med. acuta (dex) six months ago. Now healed. Tinnitus right.	A c <sup>1</sup> a <sup>1</sup>	60 45 15	40 35 0	60 50 30	80 70 35
Case 14. Age 19. F. Epistaxis. No ear symptoms. (Normal.)	A c <sup>1</sup> a <sup>1</sup>	52 48 10	52 48 10	60 60 45	80 60 45
Case 17. Age 16. F. No ear symptoms. Normal.	A c <sup>1</sup> a <sup>1</sup>	35 65 34	25 55 24	70 90 33	90 100 35
Case 18. Age 20. F. Rhinitis atrophica. Laryngitis chr. Some tinnitus and im- paired hearing.	A c <sup>1</sup> a <sup>1</sup>	35 35 15	18 25 0	35 25 30	75 60 45
Case 20. Age 15. M. (Normal ears.) No ear sym- toms. Deviatio septi.	A c <sup>1</sup> a <sup>1</sup>	60 40 18	35 25 0	90 60 32	90 60 35
Case 23. Age 19. M. Laryngitis tubc. Slight feeling of fullness in ears. Normal ears.	A c <sup>1</sup> a <sup>1</sup>	25 23 15	25 23 15	65 55 35	70 65 40
Case 25. Age 22. M. Ears normal. No symptoms.	A c <sup>1</sup> a <sup>1</sup>	35 30 15	40 35 18	70 55 38	70 55 35
Case 26. Age 24. F. Nasal polyps. No ear symptoms	A c <sup>1</sup> a <sup>1</sup>	30 45 15	20 30 8	50 65 40	70 70 35
Case 27. Age 50. M. Dev. septi. Some impairment of hearing. (Rather thick hair.)	A c <sup>1</sup> a <sup>1</sup>	30 38 10	30 36 10	45 50 15	60 55 15
Case 28. Age 15. M. Atrophic drum membranes. Tin- nitus right for two weeks. Some affectio nervi.	A c <sup>1</sup> a <sup>1</sup>	20 25 20	20 25 20	40 55 35	40 55 35
Case 29. Age 29. M. Some tinnitus left and impaired hearing after suppuration.	A c <sup>1</sup> a <sup>1</sup>	30 40 35	30 40 25	70 60 45	60 55 35
Case 30. Age 56. F. Affectio nervi acustici. Marked tubal catarrh, left.	A c <sup>1</sup> a <sup>1</sup>	50 50 20	45 35 30	70 80 45	65 70 30
Case 31. Age 79. M. Tinnitus and impaired hearing. Affectio nervi. (Cannot explain reaction of A fork.)	A c <sup>1</sup> a <sup>1</sup>	35 40 0	0 40 0	0(?) 40 25	0(?) 40 25
Case 33. Age 23. M. Ethmoiditis. No ear symptoms. Rather thick hair. Hears bet- ter via forehead.	A c <sup>1</sup> a <sup>1</sup>	45 40 25	50 40 35	70 70 55	70 80 55

Age, History, Diagnosis, etc.	Forks used.	—Schwabach—		—Schwabach—	
		Via vertex.	Via forehead.	Via mastoids Right ear.	Left ear.
Case 34. Age 32. M.	A	22	20	30	30
Tubal catarrh five years ago.	c <sup>1</sup>	20	18	30	45
No ear symptoms now. Slight affectio nervi.	a <sup>1</sup>	10	0	20	32
Case 35. Age 23. M.	A	20	30	70	90
Chronic laryngitis. Normal ears.	c <sup>1</sup>	25	32	60	72
Thick hair.	a <sup>1</sup>	25	18	45	45
Case 36. Age 64.	A	50	45	80	80
Tinnitus.	c <sup>1</sup>	40	40	60	70
Tubal catarrh.	a <sup>1</sup>	20	25	40	40
Case 38. Age 21. M.	A	10	20	40	65
Tinnitus.	c <sup>1</sup>	10	18	45	55
Some affectio nervi.	a <sup>1</sup>	10	10	25	40
(Cannot explain Rinne and Schwabach in this case.)					
Case 41. Age 22. F.	A	45	50	90	80
Chr. ethmoiditis. No ear symptoms.	c <sup>1</sup>	45	55	70	70
Slight retraction.	a <sup>1</sup>	20	20	35	35
Case 42. Age 30. F.	A	55	60	110	120
No ear symptoms.	c <sup>1</sup>	35	35	60	70
Normal drums.	a <sup>1</sup>	22	22	45	48
Case 43. Age 21. F.	A	30	30	70	70
Recently tinnitus and impaired hearing.	c <sup>1</sup>	32	32	60	60
Some atrophy of drum membranes.	a <sup>1</sup>	10	10	35	35
Case 53. Age 15. F.	A	40	45	65	65
Adenoids. No ear symptoms now.	c <sup>1</sup>	55	55	60	60
	a <sup>1</sup>	30	30	50	50
(Weber to right side though no apparent lesion.)					
Case 54. Age 27. M.	A	65	60	80	80
No ear symptoms.	c <sup>1</sup>	55	55	75	75
Drums slightly cloudy.	a <sup>1</sup>	30	30	60	60
Case 56. Age 15. M.	A	50	50	80	90
No ear symptoms.	c <sup>1</sup>	45	40	80	80
Nasal polyps.	a <sup>1</sup>	35	35	55	55
(Cannot explain Weber to left side.)					
Case 57. Age 14. F.	A	40	45	90	95
Chronic rhinitis. No ear symptoms.	c <sup>1</sup>	40	45	60	70
Thick hair. Hears better on forehead.	a <sup>1</sup>	20	25	45	55
Case 59. Age 30. M.	A	45	45	85	85
No ear symptoms. Some retraction of drums.	c <sup>1</sup>	40	40	80	80
	a <sup>1</sup>	22	22	45	45
Case 60. Age 20. M.	A	40	30	75	75
No ear symptoms.	c <sup>1</sup>	45	30	60	70
Normal drums.	a <sup>1</sup>	20	20	45	45
Case 62. Age 26. F.	A	65	65	95	100
No ear symptoms. Drum membranes normal.	c <sup>1</sup>	48	55	70	70
Thick hair.	a <sup>1</sup>	20	35	35	40
Case 64. Age 28. M.	A	30	30	55	55
Affectio nervi acustici bilat.	c <sup>1</sup>	25	30	50	50
Tinnitus left ear. Rather thick hair.	a <sup>1</sup>	15	20	30	30

Age, History, Diagnosis, etc.	Forks used.	—Schwabach—		—Schwabach—	
		Via vertex.	Via forehead.	Via mastoids Right ear.	Left ear.
Case 69. Age 23. M. <i>No ear symptoms.</i>	A c <sup>1</sup> a <sup>1</sup>	55 50 30	58 50 30	80 70 45	90 80 55
Case 70. Age 27. M. Acute laryngitis. Tinnitus left for two weeks. Some affectio nervi acustici. Rather thick hair.	A c <sup>1</sup> a <sup>1</sup>	45 40 20	50 30 15	80 50 40	80 50 35
Case 72. Age 30. M. <i>No ear symptoms.</i>	A c <sup>1</sup> a <sup>1</sup>	55 45 50	75 62 50	90 80 60	90 75 60
Case 73. Age 40. F. Nasal polyps. Cloudy drum membranes. Occasional tinnitus. Thick hair.	A c <sup>1</sup> a <sup>1</sup>	35 30 20	50 35 22	90 60 40	90 60 40
Case 76. Age 16. M. Chr. rhinitis and laryngitis. Cloudy right drum and feeling of fullness.	A c <sup>1</sup> a <sup>1</sup>	50 40 30	60 40 35	90 60 50	90 60 50
Case 80. Age 12. M. Rhinoscleroma. Some retraction of drums. Slight affectio nervi acustici.	A c <sup>1</sup> a <sup>1</sup>	45 35 25	55 38 25	90 65 40	80 65 40
Case 83. Age 20. F. Rhin. hyper. Ears normal. Rather thick hair.	A c <sup>1</sup> a <sup>1</sup>	55 45 20	62 55 30	90 80 50	92 85 50
Case 85. Age 46. F. Tumor laryngis. Affectio nervi acustici. Thin hair.	A c <sup>1</sup> a <sup>1</sup>	60 40 18	50 40 18	80 50 35	80 50 35
Case 91. Age 40. M. Rhinitis atrophica. Some cloudiness drum membranes. <i>No ear symptoms.</i> Moderately thick hair. Some affectio nervi, left ear.	A c <sup>1</sup> a <sup>1</sup>	45 30 18	50 35 25	80 50 35	80 50 35
Case 95. Age 32. F. Drum membranes normal. Increasing impairment of hearing. Thick hair. Affectio nervi(?).	A c <sup>1</sup> a <sup>1</sup>	40 25 10	45 28 10	50 40 25	55 45 30
Case 97. Age 22. F. Rhinitis. hyper. <i>Ears normal.</i> Thick hair.	A c <sup>1</sup> a <sup>1</sup>	50 35 23	63 45 18	95 65 40	95 65 40
Case 99. Age 51. M. Drum membranes normal. Retroauricular abscess left opened 4 years ago. Pain in left ear past few weeks. Bald.	A c <sup>1</sup> a <sup>1</sup>	60 50 15	45 40 5	95 70 35	100 75 35
Case 100. Age 73. M. Both drum membranes retracted. "Thumping" in ears and poor hearing past few weeks. Thin hair. Slight affectio nervi.	A c <sup>1</sup> a <sup>1</sup>	30 25 0	40 35 10	55 50 25	60 55 25

POSITIVE RINNE ON ONE AND NEGATIVE ON OTHER EAR

Age, History, Diagnosis, etc.	Forks used.	Schwabach		Schwabach	
		Via vertex.	Via forehead.	Via mastoids Right ear.	Via mastoids Left ear.
Case 2. Age 17. M. Ot. med. sup. chr. sin. Total destruction of drum.	A c <sup>1</sup> a <sup>1</sup>	68 58 42	55 50 35	90 Pos. 100 Neg. 70 58	100 Neg. 75 60
Case 3. Age 13. F. Ot. med. sup. chr. sin. Total destruction. Some vertigo.	A c <sup>1</sup> a <sup>1</sup>	70 55 30	65 50 28	110 Pos. 70 Neg. 70 25(?)	70 Neg. 60 30
N.B.—Cases No. 2 and 3 show how independently ears react to Rinne test one side as compared with other.					
Case 5. Age 11. M. Cat. tubanus dextra.	A c <sup>1</sup> a <sup>1</sup>	60 55 35	60 50 31	100 Neg. 90 Pos. 70 60	90 Pos. 80 50
Case 7. Age 20. F. Radical mastoid. (dex.) Cloudy drum (sin.) High tinnitus.	A c <sup>1</sup> a <sup>1</sup>	30 18 10	22 15 5	40 Neg. 0 Pos. 25 20	0 Pos. 0 0
N.B.—In this case closure of left ear with finger caused fork to be heard in that ear when placed on vertex or mastoid.					
Case 8. Age 51. M. Ot. med. sup. chr. dex. Ot. med. sup. acuta sin. Tinnitus right. Heard as long on vertex as mastoid.	A c <sup>1</sup> a <sup>1</sup>	75 55 20	60 45 14	60 Neg. 70± 55 25	70± 55 20
Case 16. Age 16. F. Ot. med. sup. chr. dex. No tin- nitus, etc. Heard as long on vertex as mastoid.	A c <sup>1</sup> a <sup>1</sup>	60 70 20	30 35 12	60 Neg. 70 Pos. 60 35	70 Pos. 65 40
Case 19. Age 62. M. Ot. med. sup. acuta sin. Pain in ear. Heard as long on vertex as mastoid.	A c <sup>1</sup> a <sup>1</sup>	70 65 15	45 50 15	45 Pos. 30 Neg. 45 30	30 Neg. 85 30
Case 21. Age 32. M. Chr. tubal catarrh (left). "Pres- sure" in ear, but no tinnitus. Heard as long on vertex as mastoid.	A c <sup>1</sup> a <sup>1</sup>	60 60 30	60 60 30	65 Pos. 50 Neg. 80 40	50 Neg. 60 25
Case 24. Age 49. F. Ot. med. sup. ac. sin. Tinnitus bilateral. Heard as long on ver- tex as mastoid.	A c <sup>1</sup> a <sup>1</sup>	80 70 20	45 40 10	70 Pos. 75 Neg. 60 25	75 Neg. 65 30
Case 32. Age 40. F. Healed ot. med. chronica bilater- alis. Also affectio nervi. Heard as long on vertex as mastoid.	A c <sup>1</sup> a <sup>1</sup>	20 30 8	18 30 8	15 Neg. 35 Pos. 30 15	35 Pos. 60 30
Case 45. Age 15. F. Adenoids; atrophic drums. Some impairment of hearing.	A c <sup>1</sup> a <sup>1</sup>	60 50 25	70 55 30	105± 100 Neg. 80 60	100 Neg. 80 60

Age, History, Diagnosis, etc.	Forks used.	Schwabach		Schwabach	
		Via vertex.	Via forehead.	Via mastoids Right ear.	Left ear.
Case 46. Age 50. M. Right complete destruction of drum; left retracted. Impaired hearing. <i>Affectio nervi dex.</i> <i>Catarrh tub. sin.</i> but heard as long on vertex as mastoid.	A c <sup>1</sup> a <sup>1</sup>	35 35 10	30 30 6	45 Neg. 30 10	35 Pos. 35 10
Case 47. Age 14. F. Very unintelligent. Bilat. ot. med. chr. Much destruction. Poor hearing.	A c <sup>1</sup> a <sup>1</sup>	55 30 20	60 40 25	70 Pos. 60 25	75 Neg. 55 25
(Cannot explain a in this case.)					
Case 48. Age 16. M. Acute mastoiditis left, 4 years ago. Past 3 weeks again pus. Right ear normal. Rather thick hair.	A c <sup>1</sup> a <sup>1</sup>	30 70 40	55 85 45	115 Pos. 105 50	120 Neg. 90 40
Case 49. Age 28. M. Laryngitis tubc. No ear sym- toms. Rather thick hair, but hears better via <i>vertex</i> .	A c <sup>1</sup> a <sup>1</sup>	50 55 25	30 35 18	80 Neg. 65 42	100 Pos. 75 50
(Cannot explain negative Rinne in right ear.)					
Case 51. Age 13. F. Ot. med. acuta supp. bilat. Al- most healed.	A c <sup>1</sup> a <sup>1</sup>	65 50 40	60 40 30	80 Pos. 70 50	80 Neg. 70 60
Case 52. Age 49. F. Tinnitus and poor hearing. Re- tracted drum membranes.	A c <sup>1</sup> a <sup>1</sup>	60 40 20	70 50 12	120 Pos. 90 30	130 Neg. 105 50
Case 61. Age 8. F. Cholesteatoma right with im- paired hearing. Left normal.	A c <sup>1</sup> a <sup>1</sup>	60 45 30	60 40 30	80 Neg. 60 35	85 Pos. 70 35
Case 63. Age 7. M. Ot. med. chr. sup. sin. Right normal. Child not very intelligent	A c <sup>1</sup> a <sup>1</sup>	50 60 35	45 60 30	70 Pos. 90 60	80 Neg. 90 65
Case 65. Age 32. F. Otitis externa dex. with mild otitis media acuta. Pain right ear.	A c <sup>1</sup> a <sup>1</sup>	60 65 20	50 55 20	95 Neg. 100 40	90 Pos. 100 40
Case 67. Age 47. F. Ot. media sup. acuta. dex. Pain and impaired hearing. Thick hair	A c <sup>1</sup> a <sup>1</sup>	60 50 20	65 60 25	90 Neg. 80 40	90 Pos. 80 45
Case 71. Age 22. M. Traumatic perforation left. Im- paired hearing. Some tinnitus. Thin hair.	A c <sup>1</sup> a <sup>1</sup>	40 40 25	40 30 20	100 Pos. 70 40	90 Neg. 65 40
Case 74. Age 55. F. Healed otitis media chr. sin. Oc- casional tinnitus. Subacute otitis med. dex.	A c <sup>1</sup> a <sup>1</sup>	40 35 22	40 30 12	80 Pos. 70 85	80 Neg. 75 60
Case 75. Age 45. M. Otitis media acuta sin. Pain left ear.	A c <sup>1</sup> a <sup>1</sup>	80 70 25	80 70 20	90 Pos. 70 35	100 Neg. 80 45

Age, History, Diagnosis, etc.	Forks used.	—Schwabach—		—Schwabach—	
		Via vertex.	Via forehead.	Via mastoids	Right ear. Left ear.
Case 77. Age 19. F. Radical mastoid, right, 2 years ago. Hearing very poor. Left ear normal.	A c <sup>1</sup> a <sup>1</sup>	50 45 25	35 35 20	70 Neg. 90 Pos. 60 35	70 45
Case 78. Age 16. F. Ot. med. subacuta supp. dex. Left ear normal.	A c <sup>1</sup> a <sup>1</sup>	70 50 35	60 40 25	90 Neg. 80 Pos. 80 50	80 65 50
Case 81. Age 49. M. Healed ot. med. acuta dex. Ot. med. nonsupp. acuta sin. Still some hearing impairment right.	A c <sup>1</sup> a <sup>1</sup>	30 40 25	40 40 20	90 Neg. 90 ± 80 50	90 ± 80 50
Case 84. Age 13. M. Otitis med. acuta sin. Right ear normal. Rather thick hair.	A c <sup>1</sup> a <sup>1</sup>	50 40 35	60 45 40	90 Pos. 90 Neg. 90 60	90 Neg. 80 60
Case 86. Age 11. M. Acute tubal catarrh right. Left normal.	A c <sup>1</sup> a <sup>1</sup>	80 70 45	90 60 55	120 Neg. 125 Pos. 110 55	125 Pos. 120 55
Case 87. Age 51. F. Otitis med. supp. ac. dex 2½ yrs. ago. Otitis med. supp. sub- acuta sin. Moderately thick hair.	A c <sup>1</sup> a <sup>1</sup>	35 35 25	50 45 38	90 Pos. 75 Neg. 70 52	75 Neg. 60 45
Case 88. Age 14. F. Large adenoids. Tinnitus left. Left drum retracted. Thick hair.	A c <sup>1</sup> a <sup>1</sup>	20 18 15	35 30 25	80 Pos. 50 Neg. 68 53	50 Neg. 68 50
Case 89. Age 26. F. Dry perforation right, following ot. media supp. in childhood. Tin- nitus right. Left drum cloudy and retracted. Thick hair.	A c <sup>1</sup> a <sup>1</sup>	60 50 20	70 65 30	105 Neg. 95 Pos. 75 45	95 Pos. 70 35
Case 90. Age 46. F. Right drum retracted. Total destruction left drum. Tinnitus and poor hearing left. Moder- ately thick hair.	A c <sup>1</sup> a <sup>1</sup>	60 45 25	70 60 18	120 Pos. 110 Neg. 75 45	110 Neg. 70 38
Case 92. Age 54. F. Unhealed radical mastoid left. Pains left side. Right normal except cloudiness. Apparently totally deaf left side. Thin hair.	A c <sup>1</sup> a <sup>1</sup>	25 10 0	35 20 0	65 Pos. 55 Neg. 40 20	55 Neg. 30 10
Case 96. Age 24. F. Right normal. Ot. media supp. chr. sin. Rather thick hair.	A c <sup>1</sup> a <sup>1</sup>	50 35 18	60 42 25	90 Pos. 80 Neg. 60 38	80 Neg. 50 35
BOTH EARS NEGATIVE RINNE					
Case 1. Age 11. M. Ot. med. chr. supp. after scar- letina.	A c <sup>1</sup> a <sup>1</sup>	60 55 30	50 45 25	110 85 60	120 100 70
Case 4. Age 16. F. Ot. med. chr. s. bilat. Fetid pus. Attic fistula left.	A c <sup>1</sup> a <sup>1</sup>	80 75 35	68 65 28	90 80 58	80 70 46

Age, History, Diagnosis, etc.	Forks used.	—Schwabach—		—Schwabach—	
		Via vertex.	Via forehead.	Via mastoids Right ear.	Left ear.
Case 6. Age 34. F. Right drum normal. L. shows catarrh. A typical otosclerosis with nerve involvement. Tinnitus.	A c <sup>1</sup> a <sup>1</sup>	50 25 8	40 18 4	55 35 15	80 55 25
Case 11. Age 32. F. Affectio nervi acustici. Right drum cloudy. Left drum normal. Poor hearing and tinnitus.	A c <sup>1</sup> a <sup>1</sup>	45 50 7	40 45 4	44 55 12	50 65 15
Case 15. Age 11. M. Subacute secretory catarrh bi- lateral. Tinnitus.	A c <sup>1</sup> a <sup>1</sup>	50 45 28	40 30 25	65 70 60	75 80 65
Case 22. Age 45. M. Retracted drum membranes. Tin- nitus and some impairment of hearing.	A c <sup>1</sup> a <sup>1</sup>	100 60 35	85 60 35	100 75 35	85 60 35
Case 37. Age 15. M. Right, intermittent ot. media chr. Left, unhealed radical mastoid. Rather thick hair.	A c <sup>1</sup> a <sup>1</sup>	65 90 50	30 80 30	120 100 55	100 100 50
Case 39. Age 17. M. Ot. media chr. in childhood. Right drum retracted. Tinnitus. Rhin. hyper. and adenoids. Affectio nervi. (Forks on left mastoid and fore- head apparently heard in right ear.)	A c <sup>1</sup> a <sup>1</sup>	100 90 40	100 90 40	120 90 55	120 90 55
Case 40. Age 17. F. Ot. med. s. acuta bilateralis. Earache. Impaired hearing.	A c <sup>1</sup> a <sup>1</sup>	45 60 20	45 60 20	65 75 35	75 75 45
Case 44. Age 35. F. Ot. med. chr. bilat. in childhood. Now dry. Large perforations. Impaired hearing.	A c <sup>1</sup> a <sup>1</sup>	45 65 30	45 65 30	100 100 50	90 90 45
Case 50. Age 9. F. Ot. media chronica bilat. Much destruction.	A c <sup>1</sup> a <sup>1</sup>	40 60 45	40 60 45	40 60 50	40 60 50
Case 55. Age 18. F. Ot. med. supp. chr. bilat. Tin- nitus and impaired hearing.	A c <sup>1</sup> a <sup>1</sup>	10 25 30	20 30 30	50 55 50	60 65 55
Case 58. Age 18. M. Ot. med. supp. chr. bilat. Attic fistula left. Poor hearing.	A c <sup>1</sup> a <sup>1</sup>	35 20 22	25 20 20	70 60 35	70 60 40
Case 66. Age 15. M. Ot. med. supp. chr. bilat. Im- paired hearing. Mastoid opera- tion left side.	A c <sup>1</sup> a <sup>1</sup>	65 75 40	60 70 30	110 95 60	100 90 60
Case 68. Age 14. M. Ot. media supp. acuta dextra. Ot. med. supp. chronica sinistra. Thick hair.	A c <sup>1</sup> a <sup>1</sup>	70 40 35	80 45 38	90 80 75	90 80 80

Age, History, Diagnosis, etc.	Forks Used.	Schwabach		Schwabach	
		Via vertex.	Via forehead.	Via mastoids Right ear.	Via mastoids Left ear.
Case 79. Age 16. F.	A	28	38	65	55
Adenoids; rhin. hyper. Cloudy	c <sup>1</sup>	25	32	62	50
drum membranes. Hearing much	a <sup>1</sup>	20	20	65	50
impaired. Affectio nervi.					
Case 82. Age 28. F.	A	50	80	90	100
Otitis med. supp. chr. bilateralis.	c <sup>1</sup>	45	50	75	75
Much destruction both sides	a <sup>1</sup>	30	40	60	60
Thick hair.					
Case 93. Age 20. F.	A	55	65	90	105
Large polyps right; total destruc-	c <sup>1</sup>	55	65	80	90
tion left. Suppuration and im-	a <sup>1</sup>	20	35	40	40
paired hearing.					
Case 94. Age 32. F.					
Drum membranes cloudy and	A	65	78	95	115
right retracted. Impaired hear-	c <sup>1</sup>	55	65	80	95
ing with tinnitus in left ear.	a <sup>1</sup>	20	22	35	50
(Very thick hair.)					
Case 98. Age 21. F.	A	30	45	55	75
Radical mastoid operations both	c <sup>1</sup>	30	40	32	50
sides. Hearing very poor.	a <sup>1</sup>	15	20	25	42

In the tables herewith appended, (showing in seconds the length of time three forks were heard on the vertex, forehead and mastoid), the same classification of cases is retained as in the paper entitled "A Study of the Rinne Test in One Hundred Cases." First those with positive Rinne in both ears; second those with positive Rinne in one ear and negative in the other; and lastly, those with negative Rinne in both ears. The cases here listed showed normal ears in 21; chronic otitis media in 25; acute otitis media in 14; auditory nerve degeneration in 15; otosclerosis in 1; chronic adhesive process in 2; otitis externa in 1; chronic tubal catarrh in 12; traumatic perforation in 1; retracted, cloudy or atrophic drum membranes in 12 cases. In the pathologic cases in some instances both, in others only one ear was involved.

An analysis of the figures obtained from these tables is as follows: On the *vertex* the average hearing for A (108 v. d.) was 48 seconds; for the c<sup>1</sup> weighted fork (154 v. d.) 34 seconds; and for the a<sup>1</sup> fork (435 v. d.) 22 seconds. On the forehead the A fork was heard an average of 47 seconds, the weighted c<sup>1</sup> fork 43 seconds (!) and the a<sup>1</sup> fork an average of 21 seconds. It is to be noted that the c<sup>1</sup> weighted fork was heard longer on the forehead than on the vertex, whereas the other forks were heard on the average longer on the vertex, despite the presence of hair in many of the cases. The grand average of all the forks showed for the vertex 37.1 seconds and for the forehead

37.3 seconds or, practically speaking, no difference at all. Taking the averages of the two mastoids together, we find for the A fork an average duration of 76 seconds, for the weighted  $c^1$  fork an average duration of 66 seconds and for the  $a^1$  fork a duration of 41 seconds, or a grand average of all forks via mastoid of 60.9 seconds.

The ratio between the total average of hearing of the three forks via mastoid and via forehead and vertex is as 60.9 to 37.3 seconds or actually as 3 to 2. Now we do not postulate that this is always so, but can only state the findings in the series of cases reported. These were examined in a quiet room, much time and care taken to repeat the test several times on the same patient if necessary, often having the patient return a few days later in order to check up the first examination. We may therefore state that these tabulations show the actual and accurate findings in these one hundred cases. The duration of time that the forks were heard is longer than we usually assume or probably experience, but the only explanation for this is the one we have just given. The weighted  $c^1$  fork was heard longer than the A fork in certain cases, viz: both ears in cases 15 and 30; one ear cases 19, 38 and 33; on the vertex and forehead, cases 37, 44, 40, and 66; one or both ears and vertex and forehead, cases 11, 50, 28, 17, 26, 10, 63, 65, 55, 34 and 32; on the vertex only, case 81. Normal ears, cases 33, 17 and 26; cases of otitis media chronica, cases 32, 11, 37, 40, 44, 50, 66, 63; cases of otitis media acuta, 19, 65 and 81; cases of tubal catarrh, 30, 15 and 88; cases of *affectio nervi austici*, cases 30, 31, 11, 10, and 28; chronic adhesive process, case 10. The  $a^1$  fork was heard longer than the weighted  $c^1$  fork in case 74, subotitis media; one ear, case 18, some *effectio nervi acustici*; one ear, case 79, *affectio nervi acustici*.

The actual hearing of all forks via forehead and vertex was practically the same, often despite the presence of the hair. In 19 cases where the hair was quite thick (cases 33, 35, 57, 78, 83, 91, 97, 67, 84, 87, 88, 89, 90, 96, 68, 82, 93, 94, 98) the hearing via forehead was longer than that via vertex. In 16 cases where there is no special mention of heavy hair or where the hair is thin, the hearing via forehead was longer (cases 38, 41, 42, 25, 72, 76, 80, 100, 45, 47, 48, 52, 86, 92, 55 and 79). Thus in 35 per cent of the cases (19 with thick hair and 16 with thin hair), the forks were heard longer by way of the forehead, but in the other 65 per cent the forks were perceived longer by way of the vertex.

The fork placed on the vertex, or root of the nose (in the Gardner-Brown test) rests largely by its own weight and the intensity of sound is not so much influenced by pressure used in retaining it in position; but when applied to the forehead unless the patient's head is bent back to a rather uncomfortable degree, it is difficult to keep the fork in contact with the head, without applying considerable pressure.

CONCLUSIONS: (1) On the *vertex*, the average hearing for A (108 v. d.) was 48 seconds; for the  $c^1$  weighted fork (154 v. d.) 34 seconds; and for the  $a^1$  fork (435 v. d.) 22 seconds. On the forehead, the A fork was heard an average of 47 seconds, the weighted  $c^1$  fork 43 seconds (!) and the  $a^1$  fork an average of 21 seconds. It is to be noted that the  $c^1$  weighted fork was heard longer on the forehead than on the vertex, whereas the other forks were heard on the average longer on the vertex despite the presence of hair in many of the cases. The grand average of all the forks showed for the vertex 37.1 seconds, and for the forehead 37.3 seconds or, practically speaking, no difference at all. Taking the averages of the two mastoids together we find for the A fork an average duration of 76 seconds, for the weighted  $c^1$  fork an average duration of 66 seconds, and for the  $a^1$  fork a duration of 41 seconds, or a grand average of all forks via mastoid of 60.9 seconds.

(2). The duration of bone conduction in this series of tests is apparently longer than we have in routine examinations, but this finding may be due to the peculiarly favorable circumstances under which our cases were tested. Slight variations in bone conduction, as noted in doing the Schwabach test, are of no significance, since many factors such as age, conformation, of the skull bones, concentration on the part of the individual, etc., etc. may influence the findings.

(3). In this series the ratio between the hearing via mastoids and that obtained by way of the vertex of the forehead was as 3 to 2. Despite hair there was in most of the cases (65 per cent) practically no difference in duration of hearing via vertex or forehead.

(4). Many authorities test bone conduction by way of the mastoid and it would seem, in view of the results obtained in these cases, that the bone conduction factor of the Rinne test could serve as a Schwabach, thus eliminating testing by way of the vertex or the forehead, except where the Weber test is deemed advisable, and the Schwabach is then done at the same time by the same maneuver.

The A fork (108 v. d.) is a large instrument and cannot easily be applied to the mastoid process, but the weighted  $c^1$  (154 v. d.) is comfortably held either on the vertex, forehead, root of nose or mastoid, and could thus be used for the Weber, Schwabach and Rinne tests. There is really a difference of only 46 vibrations between the A fork (108 v. d.) and the weighted  $c^1$  (154 v.d.) which, when weighted really gives a tone of d sharp, but there is a great difference in the weight and size of the fork.

(5.) The suggestion regarding the possible elimination of the A fork and use of the weighted  $c^1$  fork may be of some value to those men who do not wish to, or are unable to obtain many forks for routine work. The writer himself is very fond of the A fork for use in the Weber and Schwabach tests, where the latter is done by way of the vertex, but he simply mentions this fact for the reason above stated. The  $a^1$  fork (435 v. d.) is most valuable, not only in doing the Rinne but also in testing hearing of the voice by air conduction. Since its tone lies in the so called "speech area" (designated by Bezold as extending from about  $c^1$  to  $g^2$ ), it is assumed that if not thus heard, there is no hearing for the ordinary range of speech. (N. b. It is known that some of the harmonics of the sounds employed in speech may be much higher than those mentioned; e. g. the fifth harmonic of the vowel e has about 3000 vibrations).

(6.) The question of the part played by the round window in bone conduction is a very important one and will require careful study.

#### BIBLIOGRAPHY.

- Beck, O. München. med. Wochenschr., 1913, LX. 2778.  
 Bezold, F. Lehrbuch der Ohrenheilkunde, 1906.  
 Bezold, F. Funktionelle Prüfung des Ohres, 1897, Bd. I. II.  
 Bönninghaus, G. Lehrbuch der Ohrenheilkunde, 1908.  
 Goeckermann, W. H., Barlow, R. A. and Stokes, J. H. American Journal of Syphilis, vol. III, No. 2, April, 1919.  
 Politzer, A. Lehrbuch der Ohrenheilkunde, 1908. Archiv. für Ohrenheilkunde, Bd. I, p. 59.  
 Politzer, A. Zeitschr. für Ohrenheil., Bd. XIV.  
 Retjo, A. Laryngoscope, July, 1920.  
 Schwabach. Arch. f. Ohrenheilkunde, Bd. XXXI. Zeitschr. f. Ohrenheilkunde, Bd. XIV.  
 Steinbrugge, H. Zeitschr. f. Ohrenheil., Bd. XVIII.  
 Urbantschitsch, V. Lehrbuch der Ohrenheil., 1910.  
 Wanner, F. and Gudden H. Neurolog. Centralblatt, 1900, vol. 19, 20 and 21.

# SOME REMARKS ON THE WEBER, SCHWABACH AND RINNE TESTS.

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The subject of this paper was suggested by reason of the following facts:

1. That these tests when carefully conducted afford the otologist the best qualitative means available for determining the anatomic site of the lesion responsible for loss of hearing function, partial or complete.

2. That in the hands of a skilful examiner they may, when carefully timed in combination with air conduction tests with tuning forks, serve as quantitative tests subject to limitations as are other present day methods.

3. That in spite of the above mentioned facts, there exists too often a looseness in the method of conducting them even by credited otologists. One may observe otologic clinics here and there, where an attempt is seldom made to conduct these few simple tests even in those cases undergoing treatment for deafness. The explanation for this neglect may be one of several.

- (a) Forks may not be available, or those that are available may not be suitable for the purpose.

- (b) Lack of faith in the tests due to carelessness in technic which in turn leads to irregularity in the findings. The same holds true in other fields, whether in photography, laboratory work or vestibular diagnosis. In fact, in anything of a technical nature, careful technic is the one big essential to success.

- (c) Lack of time to apply the tests.

- (d) Lack of ability to conduct them.

- (e) Indifference.

No ophthalmologist can hope to practice his specialty successfully without making careful tests for visual acuity, visual fields and color perception, nor can an otologist hope to practice his specialty successfully and neglect the subjective hearing tests that call for no more time and skill than is required of the ophthalmologist in the making of his special tests.

As pointed out earlier, these tests are the best qualitative

means available for determining the site of the lesion responsible for loss of hearing. To be sure, with the otoscope one is able to inspect the drum membrane and determine the presence or absence of retraction, dullness, opacity, increased or diminished mobility, etc., which when present tell us that the middle ear is involved; but from the otoscopic appearance alone, one cannot say positively that the middle ear condition is responsible wholly or in part for the impairment of hearing in a given case. The history may afford some assistance, but it is not always to be depended upon, for it may be found by the functional hearing tests that the hearing is impaired by reason of a lesion in the perceiving apparatus, a neurolabyrinthitis. For instance, a physician friend presented himself for treatment of bilateral impairment of hearing, due according to his opinion to a middle ear catarrh, since he had observed that with every cold in the head the hearing would decrease perceptibly, and after the cold subsided the hearing would improve; however, with this last cold the impairment was more pronounced than usual and was lasting longer. Such history suggests middle ear trouble. The otoscopic examination revealed a somewhat dull, retracted, opaque membrane that was unduly flaccid on both sides. These findings, together with the history, would seem to clinch the diagnosis of bilateral middle ear catarrh. On the other hand, the functional hearing tests revealed Weber lateralized to the better hearing side, and Schwabach shortened on both sides, Rinne positive, and air conduction shortened. These findings did not match up with the history and otoscopic findings of middle ear trouble, but were characteristic of disease of the perceiving apparatus.

Which of the evidences was one to believe, the history and otoscopic appearances on the one hand or the functional hearing tests on the other?

The functional hearing test findings were accepted without hesitation, and the patient was asked what medicine he had been in the habit of taking for his colds in the head. He answered that he took a compound tablet known as cinchonin salicylat in appreciable doses. This corroborated the functional hearing test findings, and accordingly the medicine was discontinued and *nux vomica* substituted for antidotal purposes, with complete success. This is not a rare case. We all meet them now and then, but occasionally they go on unrecognized.

Experience eventually teaches us not to rely absolutely upon a patient's history, for in the case just cited the history volunteered by the patient was incomplete. The more complete history was obtainable only after the functional tests suggested a further inquiry. Experience teaches us not to rely absolutely upon otoscopic appearances. When it comes to estimating the amount of hearing function, we frequently find the otoscopically worse appearing ear to be the better hearing one. It is not a rare occurrence to find a membrane appreciably retracted with good hearing, in some cases approaching normal. On the other hand the functional hearing tests, carefully conducted, cannot deceive us. They can however if loosely conducted. Therefore the plea for careful technic is again emphasized.

After having obtained accurate and well balanced findings, it is essential that the otologist possess a sufficiently wide knowledge of the subject of otology, to interpret them properly.

In a little more than half the number of cases we are called upon to treat, the findings will be found to correspond typically to a disease of the conducting apparatus pure and simple, unilateral or bilateral, or to a disease of the perceiving apparatus pure and simple, unilateral or bilateral. In somewhat less than half the number, the findings will not correspond typically to either of these conditions, but will suggest a mixed condition, unilateral or bilateral, or even a disease of the conducting apparatus of one side combined with disease of the perceiving apparatus on the other. In fact the variety of combinations is legion. In all of them it is essential for successful treatment, that the examiner should be able to determine just how much one part is involved and how much the other. Furthermore he should satisfy himself as to whether the involvement of the one part is primary or secondary to the other. Finally, if they are not associated conditions, which of the two antedated the other.

The vestibular tests, important though they are, have so fascinated otologists in recent years as to divert attention from the functional hearing tests, which are vastly more important as measured by the comparative frequency of the conditions calling for these separate forms of tests. In other words, there are scores of cases of deafness to every one of vertigo. No matter whether the problem is one calling for vestibular tests or both combined, the more loosely the tests

are conducted the more irregular the findings will be, and the more irregular the findings the less dependence will be placed in them, all of which leads eventually to a distaste for, if not an actual condemnation of the tests.

A few years ago a low ebb was reached as to the estimated value of the vestibular tests, all because of irregularity in the findings resulting from faulty technic, which in turn suggested immoderate speculations as to the reasons, rather than a closer inquiry into the technic employed, the lack of which was fundamentally responsible for the irregularities.

Concerning the technic to be recommended in the making of the functional hearing tests, the writer will present only those which he feels to be most essential to success, granting at the same time the possibility of improvements.

Of first importance is the selection of a suitable fork. Ordinarily the three tests (Weber, Schwabach and Rinne) are conducted with the c fork of 256 double vibrations, weighted at the end to suppress overtones. The prevailing type seems to be the one adopted by Politzer and made by Reiner. This is the fork the writer began his work with and still uses. It has many advantages and few disadvantages. During the last fifteen years, the writer has been fortunate enough to have had several forks of the same design, made by other manufacturers, donated to him. In trying them out it was found that they showed very wide discrepancies in the duration of vibrations (variance in decrement). The shortest audibly vibrating fork of this model was fifty-six seconds. This fork gradually lessened until it eventually ceased to vibrate altogether, because an imperceptible crack in the beginning had widened eventually to a wide split. The second shortest was seventy seconds. The longest vibrating fork was two hundred and fifty seconds. With the fork of seventy seconds vibration, the positive Rinne with normal individuals was ascertained to be about twenty seconds. With the two hundred and fifty seconds fork, the Rinne was positive in the same individuals about one hundred and fifty seconds. With the twenty seconds positive fork, it was found that the normally positive Rinne findings were considerably more irregular and inconsistent than with the one hundred and ten seconds vibrating fork of Reiner make. With the two hundred and fifty seconds vibrating fork of American make, the fatigue element entered so largely, in spite of efforts to avoid it, that the findings were not at all reliable. Furthermore, several forks of

the same model made by the one manufacturer were found to vary considerably in their rate of decrement. After considerable experimenting, it was found that the ideal fork was one that vibrated somewhere between one hundred and one hundred and twenty seconds. The chance for error increases in proportion as the figures are increased above one hundred and twenty seconds or decreased below ninety seconds. The longer duration forks, besides increasing the chances of fatigue of the patient's auditory apparatus and the examiner's fingers, consumes an excessive amount of time in making the tests, especially the Rinne. Furthermore, it is more difficult for the patient to tell exactly the moment he ceases to hear the fork in the case where the decrement is more abrupt, as occurs in the case of the shorter duration fork. On the other hand, with a fork of relatively short duration, the rate of decrement is so abrupt as to increase the difficulties in estimating the finer grades of positive and negative Rinne that are possible in the longer vibrating forks. In short, the best all round fork is one that vibrates neither too long, more than one hundred and twenty seconds, nor too short, less than ninety seconds.

In order to obtain an ideal fork, a fork maker was instructed to manufacture one of two hundred and fifty-six d. v. weighted at the ends, that would vibrate approximately one hundred and ten seconds, to take the place of my Politzer-Reiner fork in the event that something might happen to it. He followed the instructions given and presented a fork that vibrated two hundred and fifty-six d. v. *with* weights, whereas the Politzer fork was two hundred and fifty-six d. v. *without* weights and decidedly lower with weights. I learned then, for the first time, that the weighted Politzer fork was not a two hundred and fifty-six d. v., but about one hundred and sixty d. v.

With the new fork of exactly two hundred and fifty-six d. v. with weights, it was found that although the total audibility by air conduction at three-fourths of an inch from the meatus was one hundred and ten seconds, the same as that of my Politzer fork, generally considered to be two hundred and fifty-six d. v., but actually one hundred and sixty d. v., there was a very wide difference in the Rinne findings in normal individuals. The normally positive Rinne with the Politzer fork is forty seconds, whereas the normally positive Rinne with the Standard forks was found to be about seventy-five seconds.

After considerable experimenting with the new fork it was abandoned in favor of the old Politzer. Accordingly, the instrument maker was directed to make another fork, with the object of eventually standardizing it after my Politzer fork, which is one hundred and sixty d. v. *with the weights*, and not two hundred and fifty-six d. v. as many suppose it to be. At the same time other improvements have been added.

It is well that in the construction of a tuning fork attention be given to the handle. The Reiner fork has a relatively thin, and at the same time, smooth metal handle. The thin handle tends to cramp the fingers more than a thicker handle. A smooth metal handle tends to become slippery after awhile, especially if the hand of the examiner is inclined to sweat. A thicker handle of gutta percha is preferable. If the tip of the handle is small, sharp at the circumference or pitted at the center, it will be less comfortably tolerated on the patient's mastoid than if free of these defects.

Having satisfied oneself that he has a fork well adapted to the purpose he is ready to begin testing.

The Weber test: The intention of the Weber test is to determine whether the sound of the vibrating fork is heard better on one side than on the other, or equally well on the two sides when the tip of the handle is pressed moderately firmly against the skull just below the hair line, midway between the two ears. The fork should never be applied to the teeth since it is insanitary to say the least, besides in the presence of a maxillary sinusitis of one side, the secretion contained in the cavity, together with the thickened mucous membrane, will tend to impair the conductivity on that side. In the presence of normal hearing, the patient does not lateralize the sound. In the case of unilateral disease of the conductive apparatus, the sound is referred to the diseased side. In the case of bilateral disease of the conductive apparatus, the sound is referred to the worse hearing ear. In the case of unilateral disease of the perceiving apparatus, the sound is referred to the normal hearing ear, and in bilateral disease of the perceiving apparatus, toward the better hearing ear. In the case of disease of the conducting apparatus of one side and perceiving apparatus of the other, it will be referred to the side with the conducting apparatus disease. In the case of bilateral mixed condition (middle ear disease with secondary internal ear involvement), it will be referred to the side with greater amount of middle

ear involvement, or the side manifesting the less amount of inner ear affection.

At the present stage of otologic development, it is hardly sufficient to determine merely that the Weber in a given case is lateralized to the right or left. For in one case where the record reads "Weber lateralized to the right", the lateralization may be so slight as to be almost indifferent, whereas in another it may be lateralized so strongly as to be referred to the right side even when the fork is placed over the left mastoid. There is a considerable difference in the overbalancing of the Weber in these two cases and also in the meaning. Therefore it would be better to determine just how strongly the Weber is lateralized, and signify it by an adjective such as mildly, moderately strongly or strongly to the right. It would be better still if we designated it approximately in inches. For instance, if the sound of the vibrating fork is lateralized let us say to the right, when placed in the middle line of the skull, it should be gradually brought past the middle line to the left until a point is reached where the patient feels doubtful about the lateralization, or begins to lateralize the sound to the left. If it is two inches or four inches, let it be so recorded in the findings.

The writer has been in the habit also of timing the Weber, not because it is absolutely necessary but to serve as a check on the Schwabach test, when that test is reached. If a discrepancy is found to exist between the Weber and the Schwabach, it tells us that there has been an error somewhere; in which case a repetition of tests becomes necessary, until the error is discovered and corrected.

Schwabach test: This test calls for even more care than the Weber. The same fork is applicable as was used in the former test. The Schwabach test is commonly made too low down on the mastoid. The writer's preference is for the hollow area corresponding to the antrum region behind the pinna, for the reason that the anatomic conditions at this point tend to correspond more nearly on the two sides than they do elsewhere on the mastoid.

The object of the Schwabach test is to determine whether the patient's bone conduction is better or worse than normal. This can be more accurately determined when it is timed with a stop watch than when it is merely guessed at. One must be sure that the control is normal, which can be ascertained only after making repeated comparison tests with other normals.

If the examiner is not normal, he must be careful to select an individual who is normal for use as a control. I have known examiners who were not normal themselves attempting to make corrections or allowances for their error, but never with any degree of satisfaction. Occasions, however, arise where correcting allowances must be made. It happens in those cases where there is a marked difference in the ages of the examiner and the patient. It is common knowledge that there is a perceptible difference in the hearing by bone conduction or otherwise of children and old people, in favor of the former.

When making the Schwabach test, the examiner should be careful to apply the fork to corresponding areas over the mastoids of the patient and the control with equal pressure, for the more firmly the fork is pressed on the mastoid the better and longer it is heard. Attention should also be given to the possibility of fatigue of the hearing organ. For instance, if a vibrating fork is applied to the mastoid of anyone, normal or otherwise, and is steadily held there for 20 seconds or more or until it is no longer heard, and then removed for 5 or 6 seconds and reapplied to the mastoid, it will again be heard. During the 20 seconds or more it was first applied to the mastoid, the hearing organ became fatigued when the fine sound could no longer be heard. During the 5 or 6 seconds pause, recuperation occurred sufficiently to permit of hearing again an even less intensive sound than was possible when the organ was fatigued. To lessen the chances of fatigue, it is well to avoid applying the fork when it is vibrating too loudly. By the time this test is reached, one can generally estimate about how long the patient will probably hear the fork on the mastoid, and begin applying it 20 or 30 seconds before it is supposed the hearing will cease. At the same time attention should be paid to rests. The best method is to interrupt its application every 2 seconds, that is to say, apply the fork for 2 seconds, withdraw it for a like period, thus alternating until the patient is sure that he hears it no longer. Again, this alternating interruption allows the patient a better opportunity to determine the difference between feeling and hearing the vibration, which at times is quite difficult with many patients when the fork is applied continuously.

It is common knowledge that when the bone conduction is better (longer) than normal, it speaks for a disease of the

conducting apparatus and when it is less (shorter) than normal it speaks for a disease of the perceiving apparatus. But this is not absolute, for there are cases where the bone conduction may be less than normal on one side in the presence of normal air conduction, because some of the bone conduction on the normal side is loaned, so to speak, to the opposite side because of a pronounced nerve lesion. Again, there are cases where the bone conduction is better than normal in the presence of normal air conduction, because it had more than a normal amount of bone conduction to borrow from the opposite side, which presents a fair degree of obstructive deafness. It must be remembered that when taking the Schwabach test, we are taking not alone the bone conduction of the side to which the fork is applied, but of the two sides together. To be sure the major portion is contributed by the side to which the fork is applied. This borrowing and contributing of bone conduction from one side to the other must be constantly borne in mind and reckoned with, when making the Schwabach and Rinne tests.

The Rinne test: The Rinne test is designated positive when the air conduction is better (that is longer) than bone conduction, negative when air conduction is less (that is shorter) than bone conduction, and neutral when bone conduction and air conduction are equally well perceived, that is one is no longer than the other.

The same fork is selected in making this test as is used in making the Weber and Schwabach tests, and the same precautions are necessary as when making the Schwabach test, as to the position on the mastoid to which the fork should be applied. Besides, the same attention should be paid to the amount of pressure with which it is applied, and also the same care should be exercised in avoiding fatigue of the hearing organ. In addition to these precautions, one must be careful to hold the fork in a definite manner and at a definite distance from the meatus while taking the air conduction, at the same time avoiding fatigue after a similar manner as when taking the bone conduction.

Concerning the position of holding the fork: A fork held horizontally will not vibrate as long as one held vertically, because when held horizontally gravitational force plays a greater role than when held vertically. Again, it will vibrate slightly longer when suspended than when held upright.

When we consider that there are six directions, three of which are at right angles to one another, and three in opposite directions, along which the sound waves travel, and eight lines at forty-five degrees to the first mentioned six lines, which are nodal lines (dead lines) where the sound waves from the primary, secondary and tertiary axes meet, one can appreciate the importance of holding the fork before the patient's ear being tested and the control in that position which permits of the most direct transmission of the sound waves to the tympanic membrane. For instance, it is not well to hold the fork before the patient's ear best adapted to permit of direct transmission and before the ear of the control in a position approaching a nodal line.

While the purpose of the Rinne test is to ascertain whether the air conduction is longer than bone conduction (positive) or shorter than bone conduction (negative), for the sake of increased accuracy, it is well to time the difference, so that when we look at the records of a case and find the Rinne positive 40 seconds, we can appreciate the fact that it approaches nearer the normal than another case where the Rinne is but 10 seconds positive. If one is thoroughly acquainted with his fork and with the technic in making the tests, it is but one step farther to interpret the findings.

If a case under examination shows a positive Rinne of 40 seconds with a fork that shows the average normal to be 40 seconds, the case may be one that is normal or one in which a neurolabyrinthitis is present. If in addition to the positive Rinne of 40 seconds, the air conduction is found to be normal, we may feel sure that the hearing is normal. On the other hand, if the air conduction is found to be shorter than normal, then the positive Rinne of 40 seconds speaks for a disease of the perceiving apparatus. In order to ascertain whether there is a disease of the perceiving apparatus or freedom from disease, it becomes essential to determine whether the air conduction is normal, and this is done by comparing the patient's air conduction with the control known to be normal, observing the same precautions noted elsewhere.

As to the variety of Rinne findings, to say the least, they are numerous and each has a different meaning. To take up a consideration of them all would carry one far beyond the limits of a single paper.

In presenting this paper, there was no idea that justice

could be done the subject in the brief span of fifteen minutes. The object has been to draw attention to what the writer considers a most important phase of the subject of otology, the value of which is in direct proportion to the technic used, hence the title of the paper, "Some Remarks on the Weber, Schwabach and Rinne Tests."

# THE WEBER TEST AND SOME PRACTICAL CONSIDERATIONS OF THE FUNCTIONAL EXAMINATION OF THE HEARING TESTS.

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In bringing this subject to your attention, the writer does not wish to present so much his own views as to elicit a full discussion from this large and experienced audience. Also, to make an earnest plea for the routine use of the tuning forks in our otologic examinations.

In the preparation of this paper, the writer does not have anything original to offer. It is my purpose to present to you the gleanings from the Otologic Literature bearing on this subject, and the results of my examination of fifty unselected cases.

Before entering into a discussion of the various methods in vogue for functional testing, we will briefly mention some of the practical points to consider in carrying out functional examinations. The first essential is taking a careful history; second, a thorough knowledge of the application and interpretation of the test undertaken; third, a noiseless room; fourth, a competent assistant.

The tuning forks we have under consideration are the Weber, Schwabach and Rinne. It is the Weber Test to which I will refer, as the other tests have been presented by other essayists.

E. H. Weber, a German physiologist, was the first to demonstrate in 1832, that a vibrating tuning fork brought in contact with the head is heard most clearly in the ear which is closed by pressure of the finger or by a piece of cotton in the meatus. Upon this fact is based the practical application of the tuning fork to diagnosis and prognosis in diseases of the ear.

All the functional tests of the ear, including those of the tuning forks have as their chief purpose the localizing of the disease, and the commonly accepted principles for the local diagnosis are as follows:

1. When the conducting apparatus is diseased, the lower tones are impaired or entirely lost and the bone conduction is increased.

2. When the perception apparatus is diseased, the power of hearing high tones is lost and bone conduction is shortened.

The physiologic basis of these principles are two commonly accepted hypotheses, namely:

1. In case of air conduction, for the perception of the higher tones the conducting apparatus is not necessary, because they can be taken up by means of "molecular vibration."

2. In case of bone conduction, the vibrations of the tuning forks act directly on the labyrinth. So that in this case we can examine directly the perception apparatus.

Accepting the above hypotheses, all of our conclusions relating to the local diagnosis are based upon the physiologic conception of the air conduction and bone conduction, but a careful review of the literature reveals varying opinions, which are not supported by scientific facts. Of the forty articles reviewed by the writer on this subject, the one by A. Retjo, *Laryngoscope*, July, 1920, treats this subject in a scientific manner and the conclusions deduced are well supported and logical.

For the perception of bone conduction there are commonly two ways accepted. (1) The pure bone conduction, (2) The craniotympanal or osteostepedial route.

Rejto's experiments disprove both of the above mentioned principles and a brief summary of his physiologic conclusions is as follows:

1. The end organ of the cochlea has only one stimulus, and that is the wave like motion induced in the labyrinth fluid.

2. In case of air conduction the perception of the lower and higher tones happen alike with the help of the conducting apparatus. The difference is only that for the former, the transforming action of the drum and ossicles is necessary, whereas for the higher tones it is quite enough if the two windows function normally.

3. In case of bone conduction, there must also arise the same wave like perilymph motion as is produced in the case of air conduction, because it is the only stimulus for the auditory nerve. This motion, directed towards the round window, arises in the labyrinthal fluid through the molecular vibration of the skull bones, but at the same time there is produced another motion directed towards the oval window. As only the first of these motions is necessary for the perception, in case of bone conduction only the functioning of the round window is required.

4. If neither of the windows is elastic, no wave like motion can arise in the fluid. There is neither stimulus nor perception.

Having discussed briefly the physiology of air and bone conductions, we will consider the local diagnostic value of the Weber test. Schwabach regards the shortening of bone conduction as always a local diagnostic symptom of disease of the perceiving apparatus. As bone conduction is perceived with the help of the second drum through the cochlear nerve, the shortening of it can be occasioned either by the disease of the round window or by the disease of the perceiving apparatus. Heretofore, otologists have accepted the shortening of bone conduction alone as a sign of disease of the auditory nerve. Although Panse twenty-two years ago called attention to the fact that disease of the round window also caused shortening of the bone conduction, we are justified in doing this if we have a guarantee of the integrity of the second drum. In this way we are not justified in supposing always a "labyrinthitis" if during middle ear inflammation the bone conduction is shortened, since the shortening of bone connection can be occasioned not only through labyrinth affection but also through disease of the round window.

Sonnenschein, in an analysis of the Weber test in one hundred cases, found the lateralization was to the poorer side in conduction diseases, and to the better side in nerve affection in all but seventeen per cent of the cases. In only eleven to fifteen per cent of the cases, did the position of the forks make any difference. His conclusions were that the Weber test confirms the diagnosis in many cases when used in conjunction with and agreeing with the results of the other functional test; that it is no aid in some cases. In some instances it even causes uncertainty owing to its great variability. The analysis of the Weber Test by other authors shows a marked variation as to diagnostic and prognostic value.

In the writer's fifty unselected cases, the Weber test lateralized to the poorer side in conduction disease in forty-two cases, to the better side in five cases, and no lateralization occurred in three cases with normal hearing.

The c. 256 d. v. weighted fork of Hartmann was used. The writer in this series did not practice transference of the Weber reaction which is done by closing the meatus of one ear. Where the transference of sound is possible, the prognosis is better.

A review of the literature demonstrated that there is no

uniformity in the forks used for the Weber, Schwabach or Rinne tests, also difference of opinion as to where the fork is to be set in the Weber test. There are also varying opinions as to the interpretations of the findings. In other words, there is no definite standard whereby the findings of an otologist in one section of the country can be intelligently interpreted by an otologist in another section of the country, such as exist among the ophthalmologist. For example, when an ophthalmologist takes a patient's vision and fields of vision, his findings can be readily interpreted by any ophthalmologist. The same cannot be said in regard to the otologist's findings.

The lack of a definite and scientific standard for determining the functional value of the ear, together with an utter disregard of the use of the tuning forks for diagnostic purposes by the large majority of men practicing otology, prompted the writer to present this subject.

This condition is well illustrated by the report of the following case. Patient M. C., age 16, school girl, gave the following history: Gradual loss of hearing for past five years. No ear trouble. Mother deaf and one brother partially deaf. Functional examination revealed the following: Hears watch at contact with both ears. Lower tone limit elevated. Bone conduction prolonged. Negative Rinne. Both drum membranes normal in position and appearance. Eustachian tubes patent. This patient has been treated with catheter inflation for a period of three years by two otologists, without ever having any functional examination.

To what can this lack of interest in the study of functional examination of the hearing mechanism be attributed? In the writer's opinion it is due to a lack of fundamental basic knowledge of the subject, and further to the fact that there is no definite standard to follow in making these tests.

As a partial remedy for this state of affairs, the writer would like to suggest that a committee from the Academy's membership be appointed to study and consider the possibilities of the adoption of a standard and uniform method for the functional examination of the ear, so that otology may attain the dignity which it justly deserves.

A committee of scientific workers from the section of Otolaryngology of the A. M. A. has done much towards the standardization of local anesthesia in nose and throat surgery, and it is reasonable to believe that a similar committee of workers could do as much for otology.

After a careful review of forty published articles relating to the functional examination of the ear, together with a study of fifty unselected cases the writer has formed the following conclusions:

1. In those cases when there are pathologic changes in the meatus or in the middle ear, the tones of the tuning fork placed on the head will be heard best in the affected ear, provided there is not at the same time an affection of the labyrinth or the round window. This is the case in about ninety per cent of all cases.

2. In case of bilateral impairment of hearing, the Weber test is of some value, as in such cases, if plugging the meatus fails to intensify the sound, we may conclude that we are dealing with a lesion deeper than the middle ear.

3. The position of the forks is apparently of some importance, as there was a difference of eleven to fifteen per cent according to position in Sonnenschein's series of one hundred cases. The forks are usually heard longer and louder on the forehead.

4. In all cases sound transference should be practiced, as the absence of transference always has a serious significance.

5. Here, as in all diagnostic examinations, we must consider the symptoms in their entirety; we must take all the tuning fork tests together to determine the diagnosis.

#### DISCUSSION OF SYMPOSIUM ON FUNCTIONAL TESTS OF HEARING.

DR. EMIL MAYER: This Academy is always glad to welcome men who have made advances in our science, and I have the honor to present to you at this time one who bears the title of "Anzac," Doctor S. A. Ewing, of Melbourne, Australia.

DR. S. A. EWING, Melbourne, Australia: Unfortunately, although I am an Australian, and did war service, I cannot lay claim to the title of "Anzac."

I feel somewhat embarrassed to have Doctor Mayer call me to this platform. I would much prefer to be back in the room. This is my fourth visit to the Old World. I first came in 1889, and naturally I was attracted to the men who had done much to place the science of medicine in its present position. The first man I saw was Pasteur. The next time, in 1892, I worked under Lord Lister at Kings. The third time, I went all through Europe. Then in the evening of my life, remembering how much we owed during the last twenty years in Australia to the work done by the American oto-laryngologists, I thought it my duty to come over and meet the men to whom Australia and the world has been very much indebted for the help they have given us and the work they have done. It has been an abiding pleasure, and will be a great joy for the rest of my life to have had the privilege of meeting

many of your men in Chicago, in Boston, in New York, and now here in Philadelphia. I cannot say how happy I am to meet you all.

DR. JOS. D. HEITGER, Louisville, Ky: When you get the Transactions and go over in detail the classified cases as Dr. Sonnenschein has arranged them, you will probably find a great many phenomena that you have noticed yourself, and these will then appear to you not so much discrepancies as faulty interpretations.

I think it is of great importance, as has been brought out by two of the essayists, that the normal hearing should be considered from the standpoint of the average of a number of known normals of the age of the patient examined rather than that of the examiner. The examiner might be examining a patient who is not of the same age as he, and if he depends upon his own bone conduction for instance, he might be led into error, particularly in the examination of a child or an older person.

A great deal of confusion has existed in the past because of the fact that writers in giving their findings merely gave the designation of the fork they used, and did not state whether it was weighted or unweighted, and because of this discrepancy one has difficulty in getting an actual picture of what the hearing range of the examined patient was. I think a great deal of this confusion is due to the fact that the majority of us do not know enough about acoustics. We don't want to go back and take up our trigonometry—it's too hard work. The ophthalmologists have been able to do more with physiologic optics than the otologists with acoustics. If we knew and applied the fundamental principles of acoustics we would probably get as much out of the subject as the ophthalmologists in their examinations, because there is an analogy between the functional examination of the eye and the ear, in that there is a visual field just as there is a field of the range of hearing. The center of fixation can be compared to the most useful part of the cochlea, namely, that portion brought into use in an ordinary conversation. The ophthalmologist has his scotomata just as we have our islands of deafness. All this has been brought out especially in Dr. Gill's paper—that the ophthalmologist in San Francisco when he reads the findings of a New York ophthalmologist can get a fair conception of the visual function of that patient. On the contrary, if a San Francisco otologist reads the average findings of a New York otologist in the functional examination of the ear, he is almost compelled to guess. The vice versa of this is equally true.

One important thing I wish to mention is that, in making the Schwa-bach test, a very simple arrangement has been perfected by Dr. White, of New York, and brought out at the International Congress of Otology in Boston a number of years ago. It is a noise apparatus to be used in such a way as to eliminate bone conduction in one ear, and is particularly practical and useful in the functional examination of the cochlea.

DR. IRVING W. VOORHEES, New York City: This work of Doctor Sonnenschein deserves something more than mere passing remark, for it is born of a high order of desire to know, and that is one way of defining science at its best.

Personally, I was taught when in Vienna to rest the vibrating fork on the mastoid, using the one marked 256 d.v. However, I have always

felt that it is utterly unscientific to compare the vibration time of the patient's ear with the examiner's, for the chances of error are infinite. The personal equation cannot be eliminated, and where the margin of shortening or lengthening is narrow, incorrect results may be drawn. Oscar Beck in 1911 firmly believed and taught us that shortened bone conduction was "suspicious for syphilis." That much is in itself of some value, for it directs us to have a Wassermann done, when this test might not otherwise be thought of. But like all other signs and symptoms in medicine, one must never depend on it or any other one thing for diagnosis, since only a composite picture can make our guess reasonably sure. Functional testing of the ear with tuning forks is reliable chiefly in lesions which are pronounced. For accuracy such as is required in court cases, one should go through the complete Edelmänn-Galton tests, which is a time consuming and laborious procedure.

Doctor Sonnenschein should be praised for his painstaking industry in testing out the Schwabach in such a large number of patients so thoroughly. The value to be derived therefrom must be worked out in the individual experience of each one of us.

DR. CLAYTON M. BROWN, Buffalo, New York: In the discussion of Doctor Mackenzie's paper, which is both interesting and timely, there are two points which I wish particularly to emphasize.

First, the importance of accurate instruments in making our tests; second, the correct interpretation of the findings.

Doctor Mackenzie has had to exercise some patience and perseverance to obtain a suitable tuning fork; but then I think he is Scotch. I wonder if we appreciate how much thought, time and perseverance must have been exercised by that master otologist, Bezold, in the production of the forks to which he would lend his name. It was my very good fortune to secure a set of Bezold-Edelmänn forks, and I feel that they are absolutely reliable and accurate. Certainly the domestic instrument makers, and nearly all the foreign instrument makers, have much to learn from Edelmann in accuracy and the overcoming of overtones. I use the Edelmann capital A for Weber and Schwabach, and the small a for Rinne. Ten seconds after the first impact these forks are free from appreciable overtones. With the small a, the normal duration of air conduction over bone conduction is 45 seconds, and this should be accurately determined by a stop watch. Edelmann a forks are produced in sufficiently large quantities, so that it seems we might be able to standardize on Rinne.

As you know, perception by air conduction by the opposite ear is practically nil with the Edelmann small a, which adds materially to its accuracy in the making of the Rinne test.

The second point is the correct interpretation of the findings. In the case cited by Doctor Mackenzie he was able, by correlating his findings, to exclude the otoscopic findings, the functional tests and the history overbalancing the appearance of the membrana tympani. In another class of cases our functional tests, unless correlated with the otoscopic findings and history, may lead us far astray.

It seems to me that there is no class of ear cases which, through this lack of correlation, passes unrecognized and is so often mistreated on this account as cases of otosclerosis. The functional tests point to

trouble with the sound conducting apparatus, and not infrequently it is not recalled that the foot plate of the stapes is a part of the sound conducting apparatus, and that its fixation in the oval window gives the same functional test findings for Weber, Schwabach and Rinne as does an obstructed Eustachian tube with retraction and fixation of the membrana tympani.

We need better tuning forks and a more correct interpretation and correlation of our findings.

DR. SEYMOUR OPPENHEIMER, New York City: There has been a great tendency recently to underestimate the value of these tests. In fact, there has been a tendency as well for many men to disregard these tests entirely, and fail to employ them simply because they felt that here and there, in exceptional cases, the findings were not in accordance with the clinical history. Nevertheless, from my own observation, these tests have stood the test of time as a method of differentiation between disease of the sound perceptive apparatus and disease of the sound conductive apparatus. Any confusion that has arisen in my work has been in those cases where there was bilateral deafness, or in cases where there has been disease of the middle ear on the one side and disease of the internal ear associated with a disease of the sound conductive apparatus on the other side.

The question of interpretation of these tests is very important, but it is not necessary to employ a large series of tuning forks for that purpose, excepting in those cases where there are tonal gaps, as in deaf mutes. The employment of three or four forks is usually all that is required.

It is necessary in conjunction with this testing to estimate the combined findings of these three tests, plus the clinical history of the case and the objective findings, as evidenced by the appearance of the fundus of the ear.

What is most desirable is the construction of uniform tuning forks and the conduction of uniform tests, so that, as has been said, in our reading the literature on the subject we might be able to know with some certainty that the examiners in various places are conducting their tests exactly along the same lines.

I think this whole subject has been summed up most tersely by Doctor Mackenzie, when he says that the value of these tests is in direct proportion to the accuracy of the technic employed.

DR. G. HENRY MUNDT, Chicago: For several years I have been conducting these subjective tests of hearing rather accurately. There is no doubt that we should, as Doctor Heitger has said, get acquainted with our forks. If a man will get a good tuning fork and get acquainted with it, use a stop watch and follow through some hundreds of cases, he will learn to put absolute dependence on his subjective tests of hearing, because they are more accurate than anything else we know in otology.

There is one thing that we must bear in mind, and that is that in the first examination of a patient with tuning forks the findings will often not be accurate, because of the lack of mental stability of the individual. I have frequently had patients in whom the tuning fork tests were not borne out by the other findings and symptoms, but when

I made the test the second time and talked to the patient, so that he became mentally alert for what I wanted, I got the results I expected. I think there is no doubt that you can put absolute dependence on your tuning fork tests.

DR. HORACE NEWHART, Minneapolis: After listening to the very excellent and instructive papers of this symposium on hearing tests, I am convinced that though our interest has been greatly stimulated no notable progress in otologic practice will result unless we, as a scientific body, take some definite action upon this important subject which has been so ably presented and discussed. Therefore, if it is in order at this time, I would move that the Chair appoint a committee of four *to take up the matter of standardizing our tuning forks, the technic of making tests of the acuity of hearing and the methods of recording the results of such tests*, the object being to secure accuracy and uniformity of procedure in our work. This committee shall cooperate, if possible, with similar committees from the other national societies of otologists, i. e., the American Otological Society, the American Laryngological, Rhinological and Otological Society and the Section on Laryngology, Otology and Rhinology of the American Medical Society. The Chair appointed as this committee:

Dr. Robert Sonneschein	Dr. E. G. Gill
Dr. George W. Mackenzie	Dr. L. W. Dean

DR. ALBERT H. ANDREWS, Chicago: We hear a good deal of discussion about tuning forks—good forks and bad ones. I want to say that every tuning fork, no matter how good, should be standardized, and that standardization of a tuning fork consists in testing a number of normal ears with that individual fork, and taking the average time it can be heard both by air and by bone conduction as the standard for that fork. Forks of the same tone and made by the same manufacturer cannot all be heard the same length of time. In writing articles, both the pitch and the standard of the fork used should be given.

DR. ROBERT SONNENSCHN (closing): Doctor Mackenzie reported a case in which quinin was the cause of the auditory nerve change. I am glad to hear about it. In Chicago we see practically no cases of malaria, for which quinin is of specific value, and as many people have an idiosyncrasy to quinin I have not used it.

So far as determining the exact pitch of forks is concerned, as Doctor Mackenzie stated, certain forks have been of one pitch or another, and yet there was no certainty regarding them. I read a paper before the Chicago Laryngological Society this year on the use of resonators as possible aids in diagnosis. By this means you can test your fork and see whether it is as designated. If you set your resonator at a certain point, say small  $a^1$ , and find the maximum resonance is at that point, then you know that fork is as marked.

Unless these tests are accurate they are of no value. If you know that your tuning fork excited in a certain way vibrates a certain number of seconds, and when placed on the patient's head it is heard for a certain number of seconds, then you know at once whether the hearing is diminished, normal or increased.

Doctor Oppenheimer's statement that you do not need all the forks is very apt. If a man has a low fork, a medium fork and a high fork

he can do all the ordinary routine tests. He cannot determine those cases accurately, the lowest and the highest, but for the average test in determining the relation of air and bone conduction he has enough.

DR. GEORGE W. MACKENZIE (closing): In closing I would like to bring to your attention a recently discovered combination of fork test findings that may prove eventually to be of clinical value in the diagnosis of mastoid empyema. I have termed it the Weber-Schwabach paradox.

In the case of obstructive disease, for instance middle ear catarrh, the Weber is referred to the affected side in the case of bilateral lesions, and at the same time the bone conduction is better (longer) than normal on the affected side in the case of a unilateral lesion, and longer on the worse hearing side in the case of bilateral lesions so long as the inner ear remains unaffected.

In the case of obstructive disease, pure and simple, the combination of Weber to the worst hearing side with greater lengthening of bone conduction on the same side are consistent findings. It, however, happens now and then that this consistency is lacking. For instance, a patient with impairment of hearing, let us say of the right side, because of middle ear suppuration, with a normal left ear, reveals the Weber distinctly referred to the right ear, even when the fork is carried several inches to the left of the midline of the skull; but when the fork is applied to the mastoid in taking the so-called Schwabach, instead of finding the bone conduction longer on the right than on the left, it is found to be shorter. Surely this is paradoxical, but I have found an explanation that seems entirely reasonable, and have confirmed it in those cases in which opportunity was afforded.

I believe that the Weber-Schwabach paradox will eventually prove to be an important sign of mastoiditis. The cases where the paradox may be of the greatest value are those in which there is practically no gross external evidence: namely, those in which there is no external swelling or tenderness over the mastoid.

In the case of mastoiditis where there is softening of the bony trabeculae, granulation tissue and pus within the mastoid spaces including the antrum, the sound waves do not reach the auditory apparatus as readily by the mastoid route as in the cases with a normal mastoid. This hindrance tends to shorten the bone conduction via the mastoid; more so than by the route from the midline of skull as occurs when making the Weber test.

In making the test it is important to use the stop watch and time the Weber as well as the Schwabach.

Lest someone might think that I wish to limit the interpretation of the paradox to the above character of findings only, I desire to call attention to the fact that it may manifest itself in several forms. Occasionally the Schwabach may be normal, when lateralization and increased length of the Weber would suggest a lengthening of the Schwabach. Again, the Schwabach may be found to be lengthened but considerably less so than might be expected from the character of the Weber.

# A STUDY OF THE TONAL RANGES IN LESIONS OF THE ACOUSTIC NERVE AND LABYRINTH.

L. W. DEAN, M.D. AND C. C. BUNCH, PH.D.

IOWA CITY, IOWA.

In making this study, three things were determined; first, the upper limit for the audition of tones; second, the lower limit; third, the variations in the range between these two.

The upper limit was determined by means of the Galton

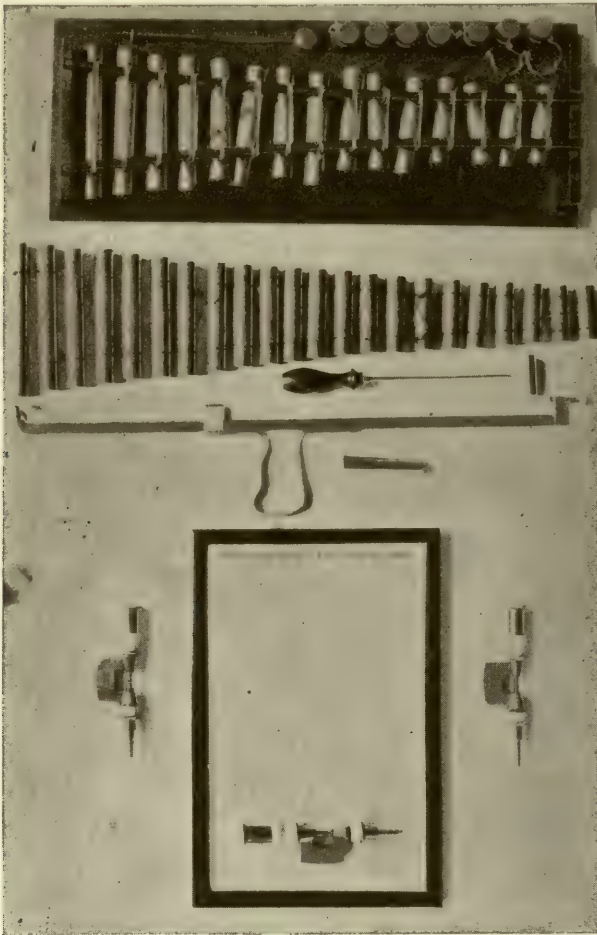


Fig. 1. Galton whistle, monochord, Koenig cylinders.

whistle, the Strychen monochord, and the Koenig cylinders. (Fig. 1). The lower limit was determined by means of the Bezold forks.

The variations in the range between the upper and lower limits for the audition of notes were determined by means of the audiometer (Fig. 2) and the Bezold series of tuning forks.



Fig. 2. The Audiometer.

The following is a brief description of the audiometer. A more complete description appeared in the Transactions of the American Otological Society, 1919, and in the Transactions of the American Laryngological, Otological and Rhinological Society, 1921.

If, after having decreased the current sufficiently, one should connect a telephone receiver in the circuit of the ordinary lighting system, he would hear a tone, more or less

pure in quality, of a pitch of approximately 60 d.v. per second. The audiometer shown in figure 2 is nothing more or less than a form of an electric generator differing from the ordinary commercial types of generators, in that the current it generates is comparatively small, and the rate of vibration is variable between 30 per second and 7070 per second.

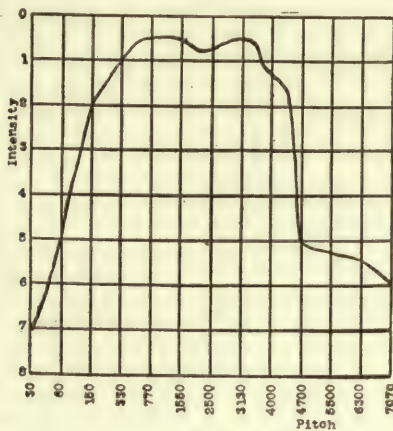
Both the number of vibrations in the telephone receiver and the intensity of vibration can be accurately controlled. Hence different notes with intensities that can be measured are produced. Notes may be so faint they cannot be heard or so loud as to be painful. In the figure, A and B are the generators proper. These are connected to a telephone through the switch H on the control board shown in the lower half of the illustration. C is an adjustable speed driving motor regulated by means of the rheostat E. D is a speed counter connected to the dial, F, which is calibrated in terms of vibrations per second. The strength of the current through the telephone is varied by means of a series of resistances at G. These are so arranged that with each change of the pointer there is an increase or decrease of 400% in the current passing through the telephone. A consists of two plates, one fixed and the other attached to the rotating shaft of the motor. On both these plates teeth are cut. As the teeth of the movable wheel pass those of the fixed one, the magnetic field, built up between them by a coil placed between, varies, causing an oscillating current to pass through a second interlying coil which is connected to the telephone. Thus we have a means of producing an oscillating current which varies in frequency and in strength, passing through a telephone. Here the electrical energy is transferred into that of sound and we have a range of tones lying between 30 d.v. and 7070 d.v. varying in intensity from those painfully loud to the normal ear to those too faint to be heard.

As the upper limit of the audiometer is 7070 d.v., that part of the tonal range between 7070 and its upper limit we have not studied. We know of no way of determining the audition of notes in this part of the range. We expect Mr. Bunch will soon have perfected a machine which will accurately measure this.

The records with the audiometer are easily indicated by means of a graph shown in Fig. 3. The pitch of the tones is indicated at the bottom and the strength of the tone by the

height of the record on the graph, no tones at all being normally heard at zero. The curve shown on the graph is the field of hearing for a normal ear. Any such curves must be dependent upon the instruments by which they are determined. In the audiometer, the factors which determine the strength of the electric current are fixed by nature of the construction. The only variable not under absolute control is the telephone receiver. No two telephone receivers are exactly alike, and if two different makes are used the results are likely to differ considerably. However, with telephones of the same type and age, an interchange would not result in

PLATE III



Curve of Normal Hearing

Fig. 3. Normal audiometer curve.

greater changes in the normal curve than occur in successive tests with normal observers under the best of conditions, because of the fluctuation in the attention and physical condition of the observer.

It appears from the general shape of the curve that the ear is most sensitive to tones in the region between 300 d.v. and 3,000 d.v. As stated above, an exchange of telephones would cause a difference in the contour of the normal curve. Nevertheless, it has been shown by many careful experimenters that the ear is most sensitive to tones corresponding in frequency with those of the human voice, and these tones are known to lie in this range. This fact has been used by the manufacturers of the receivers, for they make them most sensitive to fre-

quencies in the neighborhood of 1,000 d.v. It is quite evident from the shape of the normal curve that it takes less current to arouse a sensation of hearing for tones between 300 d.v. and 3,000 d.v. than in any other part of the hearing range.

We are of the opinion that the larynx of the human being is best adapted to produce notes from 500 to 3,000 because our cochlea is most sensitive to these notes.

#### PLATE IV UPPER LIMIT OF HEARING

Physics		Otology	
Winkelmann	24000 d.v.	Phillips	48000 d.v.
Barton	40000 "	Ballenger	22097 "
Spinney	32000 "	Bezold	41000 "
Catchpool	28000 "	Kerrison	41000 "
Hegener	20000 "	Hovell	42000 "
Miller	20000 to 30000 "	Barr	20000 "
Schwendt	20000 " 27361 "		
Schulze	20000 "		
Struycken	22000 "		
Miscellaneous			
Scripture	25000 to 50000 d.v.		
Sauveur	6000 "		
Chladni	8192 "		
Wollaston	24000 "		
Savart	24000 "		
Despretz	36864 "		
Blake	40000 to 60000 "		
Gildemeister	25000 "		
Our Results			
Galton Whistle	Limit	Calibrated to	
No. 1029	21000 d.v.	29000 d.v.	
" 1813	23000 "	25000 "	
Koenig Cylinders			
No. 1	49152 v.s.	65536 v.s.	
" 2	43960 "	65536 "	
Monochord A.C.	19000 d.v.	25000 d.v.	
B.C.	20000 "		

Fig. 4. Shows the upper limit of hearing as noted by various observers. All observations are noted in double vibration except those of the Koenig cylinders which are recorded in single vibration.

In the following charts the normal curve is indicated by a continuous line—those for the right ear by dashes, of the left ear by dots.

One of the important diagnostic points for lesions of the nerve and its end organ is a lowering of the upper limit of hearing.

The figures on the screen show the differences in opinions regarding what constitutes the upper limit.

If 48,000 d.v. is the upper limit of hearing and we find that our patient's upper limit is 23,000 d.v., we must answer that there is a lesion of the nerve or end organ.

In no case have we found the upper limit of hearing to exceed 25,000 d.v. We are of the opinion that this should be considered the approximate maximum upper limit. We are inclined to believe that the structure of the cochlea determines this, and that no tone much higher than 25,000 d. v. can be heard.

The intensity of the note produced has an influence upon the upper limits. With the instrument producing the more intense notes, the upper limit will be higher. Hence, with different Galton whistles, different upper limits are found in the same patient.

When a note of more than 25000 d.v. is apparently heard, we are inclined to think that the patient is hearing a noise and not a musical sound. Noises are characterized by their irregularity or suddenness, musical sounds by their comparatively smooth and even flow. Noises are produced by irregular or nonperiodic vibrations, while musical sounds are produced by those which are regular and periodic.

There is usually a decrease in the upper limit with advanced age. Koenig, the French physicist and instrument maker, reported his upper limit at 41 years as 23000 d.v.; at 57 years, 20480 d.v.; at 67 years, his upper limit had fallen to 18432 d.v.

We are of the opinion that the lowering of the upper limit with age is not a physiologic process; that it is due to a lesion of the nerve or end organ the result of arteriosclerosis, toxemia or what not.

As a result of a routine, exact measurement of the tonal range of our otologic cases, we have come to the conclusion that lesions of the acoustic nerve and its end organ are exceedingly common. We feel that these lesions are much more common in the ear cases than are nerve and fundus lesions in the ophthalmologic service. Two years ago Emerson (Transactions of the American L. R. & O. Society, 1920) called our attention to the frequency of the inner ear lesions in so-called middle ear diseases. Our observations so far would lead us to think that middle ear lesions not accompanied by lesions of the inner ear are uncommon. However, it is our intention to devote the coming year to the study of

the tonal ranges of the diseases of the middle ear, and we hope to have a more definite opinion in this matter.

In lesions of the nerve or end organ, the upper limit is occasionally not cut down, and it is not right to exclude so-called inner ear diseases because there is no diminution in the ability to hear the highest notes.

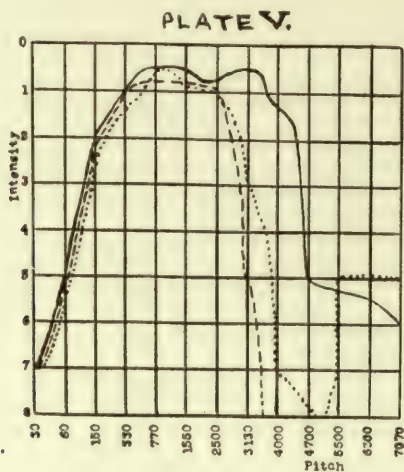


Fig. 5.

Dr. S. Age 27.

Diagnosis: Neuritis of Nervus Cochlearis.

Hearing, Right: Whisper, 15 feet. Left: 15 feet.

Forks	50 d.v.	c	c <sup>1</sup>	c <sup>2</sup>	c <sup>3</sup>	c <sup>4</sup>	c <sup>5</sup>
R	4/4	8/8	12/12	18/18	24/24	48/48	1/120
L	4/4	8/8	12/12	18/18	24/24	48/48	1/60

Upper Limit

Galton R 20000 d.v. L 20000 d.v.

Koenig R 43960 v.s. L 43960 v.s.

Monochord A.C. R 17000 d.v. L 17000 d.v.

B.C. R 18000 d.v. L 18000 d.v.

Bone Conduction: R -2 sec. L -3 sec.

Low Limit: 11 d.v. each.

Fig. 5 shows the tonal range of a patient with neuritis of the nervus cochlearis right and left. Note that while there is a diminution in the audition for notes from 3,000 to 7,000, in the right ear, and from 4,000 to 5,500 in the left ear, the upper limit as determined with the Galton whistle, Koenig cylinders, and monochord by air conduction and by bone conduction is practically normal. You will note the diminution in the power to hear the 4096 d.v. fork and the diminished bone conduction, which would make a diagnosis

of a lesion of nerve or end organ. All our observations with the Koenig cylinders are reported in single vibrations.

Again in inner ear lesions we may have a normal tonal range as measured with the audiometer and with the tuning forks.

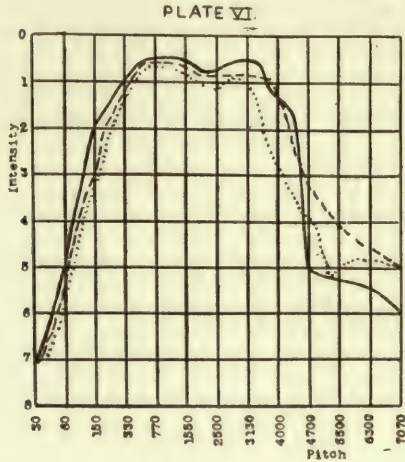


Fig. 6.

Mr. C. L. H. Age 35.

Diagnosis: Neuritis Acustica. Postinfluenzal.

Throat also bad at that time.

Voice: R Whisper, 15 feet. Spoken 45 feet.

L Whisper, 15 feet. Spoken 45 feet.

Forks 50 d.v.	c	c <sup>2</sup>	c <sup>3</sup>	c <sup>4</sup>	c <sup>5</sup>		
R	3/4	6/8	10/12	24/24	36/36	48/48	60/60
L	3/4	6/8	10/12	24/24	36/36	48/48	60/60

Upper Limit

Galton	R 19000	L 19000
Koenig	R 40960 v.s.	L 40960 v.s.

Monochord A.C. R 16000 L 16000

B.C. R 18000 L 18000

Bone Conduction: —8 sec. each.

Fig. 6 shows the tonal range of a case of bilateral acoustic neuritis. Note that the 4096 d.v. fork is heard normally, and that the tonal range for each ear is normal, and that hearing for voice and whisper is unimpaired. The upper limit as measured with the Galton whistle and the monochord is decreased, and bone conduction is greatly diminished—8 seconds in each ear. In chronic otorrhea with lesions of the cochlea well marked, we occasionally find that the bone conduction which, of course, can be measured only with tuning forks of about 512 d.v. or less, is normal or even increased. In mak-

ing perimetric examinations of the eyes, no ophthalmologist would conclude that because the outlines of the visual field were normal or because there was no central scotoma, the nerve or retina was functioning normally. Neither should we as otologists conclude because the upper limit happens to be normal, or because the tonal range as measured from 30 d.v. to 4096 d.v. is found normal, or because the bone conduction as measured with the  $c^1$  or  $c^2$  fork is found to be normal, that there is no lesion of the acoustic nerve or its end organ. A lesion of nerve fibers or of cells in the end

PLATE VII

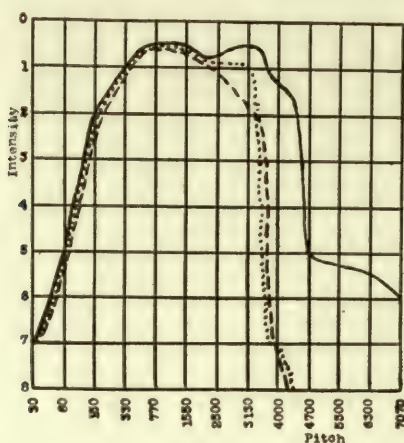


Fig. 7.

Dr. N. Age 37.

Diagnosis: Neuritis Acustica.

Voice: R Wh. 15 ft. Sp. 45 ft.

L Wh. 15 ft. Sp. 45 ft.

Forks	50 d.v.	$c$	$c^1$	$c^2$	$c^3$	$c^4$	$c^5$
R	4/4	8/8	12/12	18/18	24/24	48/48	1/100
L	4/4	8/8	12/12	18/18	24/24	48/48	1/180

Upper Limit

Galton R 18000 L 15000

Koenig R 43960 L 30720

Monochord A.C. R 13000 L 9000

B.C. R 13000 L 9000

Bone Conduction: R -2 sec. L -4 sec.

organ will interfere with the hearing only of those particular notes which these structures are concerned in receiving and transmitting, and there is no reason why a minute lesion confined to any part of the cochlea should interfere with the function of the rest of the organ.

Careful examination of the tonal ranges of individuals supposed to have normal hearing furnishes some very interesting results. Some of our very best cases from the research standpoint were discovered by Mr. Bunch in making his laboratory examinations in the Psychological Department. Later in this paper, we report one of these cases that was of much interest to us.

The examination of the assistants in the clinic during the last two years has shown that three of them have unsuspected lesions of the auditory nerve.

PLATE VIII

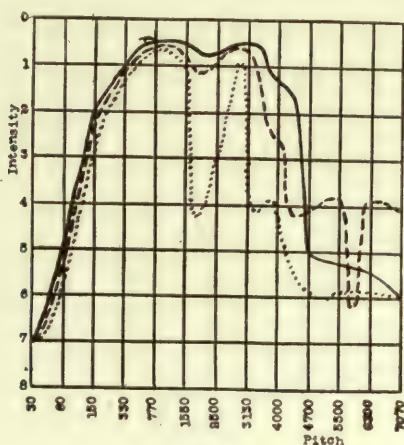


Fig. 8.

Dr. E. Age. 32

Diagnosis: Hyperplastic Otitis Media with Cochlear Degeneration.

Voice: R Wh. 15 ft. Sp. 45 ft.

L Wh. 13 ft. Sp. 40 ft.

Forks 50 d.v.	c	c <sup>1</sup>	c <sup>2</sup>	c <sup>3</sup>	c <sup>4</sup>	c <sup>5</sup>
R 4/4	8/8	18/18	24/24	36/36	48/48	60/60
L 4/4	7/8	15/18	20/24	30/36	40/48	58/60

Upper Limit

Galton R 21000 L 21000

Koenig R 43960 L 43960

Monochord A.C. R 17000 L 17000

B.C. R 19000 L 19000

Bone Conduction: R —3 sec. L —4 sec.

Fig. 7 shows the tonal range of one of the assistants in the clinic. Note the diminution in the audition for notes from 3500 to 7000 d.v. confirmed by the diminution in the power of hearing the 4096 fork in each ear. Bone conduction

was decreased; the hearing for voice and whisper, however, was normal.

Fig. 8 shows the tonal range of another assistant in the clinic. His hearing as determined with the whisper and voice was normal; the examination with the audiometer and the tuning forks show marked decrease in the audition of certain notes. Bone conduction is diminished.

Fig. 9 represents the findings in a third assistant in the clinic. Note again the decrease in the upper part of the tonal range as measured with the audiometer, confirmed by

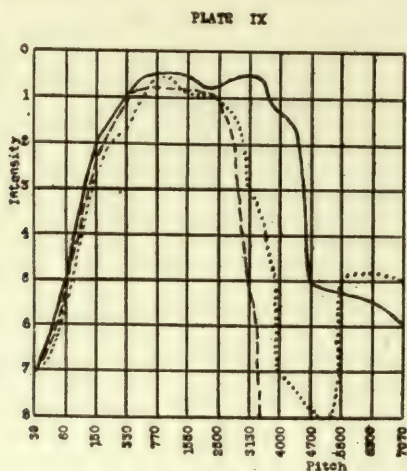


Fig. 9.

Dr. S. Age 26.

Diagnosis: Neuritis Acustica.

Voice: R Wh. 15 ft. Sp. 45 ft.

L Wh. 15 ft. Sp. 45 ft.

Forks 50 d.v.	c	c <sup>1</sup>	c <sup>2</sup>	c <sup>3</sup>	c <sup>4</sup>	c <sup>5</sup>
R 4/4	8/8	12/12	18/18	24/24	48/48	1/120
L 4/4	8/8	12/12	18/18	24/24	48/48	1/60

Upper Limit

Galton R 20000 L 20000

Koenig R 43960 L 43960

Monochord A.C. R 17000 L 17000

B.C. R 18000 L 18000

Bone Conduction: R —3 sec. L —2 sec.

the diminution of the power to hear the 4096 d.v. fork.

Three out of the eight clinical assistants examined in the clinic had these distinct inner ear lesions. This suggests to us the fallacy of depending upon comparative tests in order to determine the patient's powers of hearing. A comparative test is not reliable unless we are certain that the hearing of

the individual with whom the patient is to be compared is normal. These three assistants had been testing the ears of patients in our otologic clinic. If we had depended upon comparative results, these men comparing the patient's hearing with their own, assuming their hearing was normal, would have had results which would have been untrustworthy. It is not a safe thing to attempt to determine the upper limit of hearing of your patient by comparing his with yours, unless you know that your limit is normal.

Fig. 10 shows the tonal range of a patient taken before and after the removal of faucial tonsils. This chart was

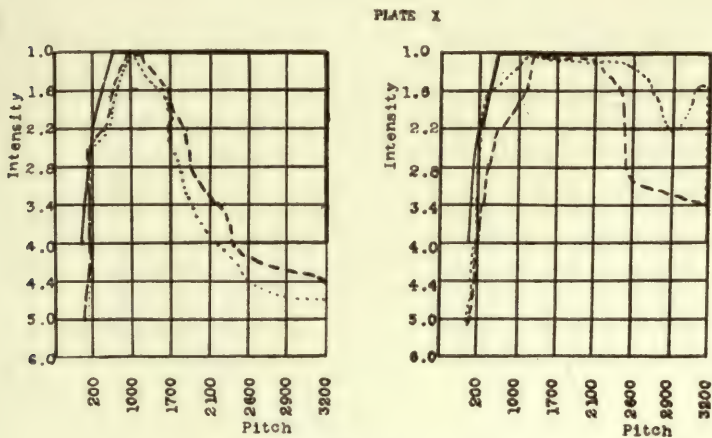


Fig. 10.

Mrs. E. C. G. Age 32.

First Test October 31, 1918. Second Test June 6, 1919.

Diagnosis: Acoustic Neuritis secondary to Chronic Tonsillitis.

Tonsils removed November 8, 1918.

Voice: R Wh. 15 ft. Sp. 45 ft.

L Wh. 15 ft. Sp. 45 ft.

Fork: .5 R 45/60 L 45/60

Bone Conduction: R —8 sec. L —10 sec.

made with the old audiometer which had a different form from the new one. This patient had an unsuspected defect in the tonal range and was one of the cases that was discovered by Mr. Bunch in carrying out his laboratory class experiments. On questioning her, the fact was elicited that she suspected that her sense of hearing for faint or distant sounds was not quite normal. The diagnosis was acoustic neuritis secondary to chronic tonsillitis. Six months after the removal of tonsils, the measurement of her tonal range

showed that it approached the normal. Notice the marked improvement in the audition of the higher notes in the range as measured with the audiometer. The patient reported that she could hear the noises of crickets and other insects that she had not heard before.

Fig. 11 shows the measurement of the tonal range of a patient who was in the service of Dr. Albright. A diagnosis of acoustic neuritis was made in January; tonsils were removed in January; six months later the tonal range was again analyzed. Note the disappearance of the gap in the right ear and the improvement in the left, but it is not so marked

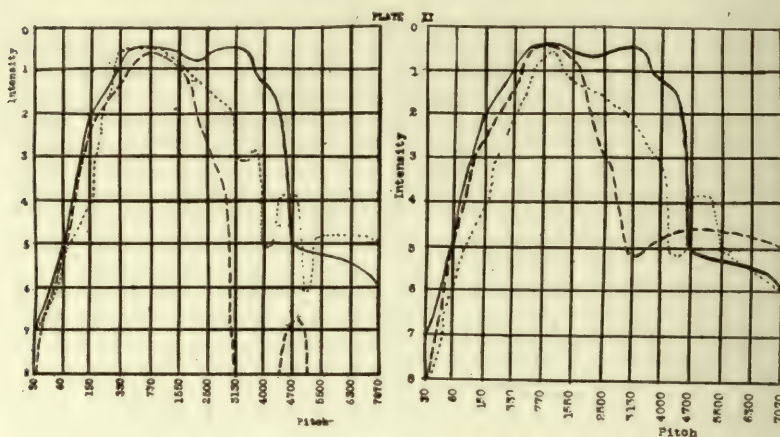


Fig. 11.

Mr. G. J. D. (Dr. A.) Age 25.

Diagnosis: Acoustic Neuritis.

First Test, January 19, 1921.

Voice: R W 10 ft. S 30 ft.

L W 15 ft. S 45 ft.

Influenza, February, 1919, with paralysis of right side lasting two or three days.

Upper Limit

Galton R 17000 L 21000

Koenig R 32768 L 40960

Monochord A.C. R 15000 L 16000

B.C. R 18000 L 18000

Second Test, June 23, 1921.

Tonsils removed, January 22, 1921.

Voice: R W 15 ft. S 45 ft.

L W 15 ft. S 45 ft.

Upper Limit

Galton R 20000 L 22000

Koenig R 40960 L 43960

Monochord A.C. R 19000 L 19000

B.C. R 20000 L 20000

as in the right, which was the poor ear. There were also an increase in the power of hearing whisper and voice in the right ear and the upper limit, which had been lowered, returned to normal.

Fig. 12 is another plate showing the influence of the re-

removal of tonsils upon the tonal range in certain cases where the lesion of nerve or end organ or both is secondary to tonsillar infection. This patient came complaining of extreme vertigo; the attacks were becoming more severe; the vertigo was rotatory in type; during the attack the patient vomits and falls to the left. This was on September 20, 1920. Note

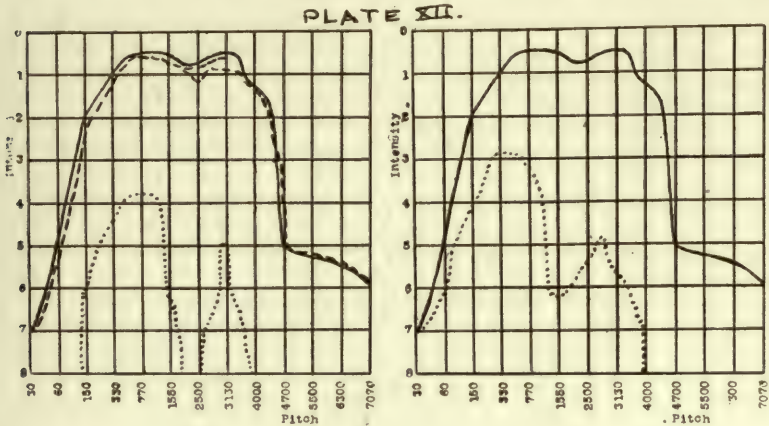


Fig. 12.

Dr. H. A. B. Age 36.

Diagnosis: Labyrinthitis, left, secondary to diseased tonsils.

Date: September 1, 1920.

Voice: R Wh. 15 ft. Sp. 45 ft.

L Wh. 8 in. Sp. 4 ft.

Forks c c<sup>1</sup> c<sup>2</sup> c<sup>3</sup> c<sup>4</sup>  
L 2/2 3/4 2/6 1/8 0/12

Upper Limit

Koenig R 40960 L 40960

Monochord A.C. R 14000 L 13000

B.C. R 16000 L 17000

Bone Conduction: Left, —6 sec.

September 8, 1921.

Voice: L Wh. 10 in. Sp. 4 ft.

Forks 50 d.v. c c<sup>1</sup> c<sup>2</sup> c<sup>3</sup> c<sup>4</sup> c<sup>5</sup>  
L 3/4 7/8 10/12 20/24 18/36 0/48 0/60

Upper Limit

Galton R 17000 L 16000

Koenig R 40960 L 40960

Monochord A.C. R 13000 L 15000

B.C. R 15000 L 15000

Bone Conduction: Left —3 sec.

the diminished hearing in the left ear as indicated by the audiometer curve; also the tone gap between 2000 d.v. and 2500 d.v.; the 2048 d.v. and the 4096 d.v. forks were not heard in the left ear; the upper limit was much lower. The test-

ing of the vestibular apparatus did not give any definite information. Bone conduction was 6 seconds. Because of the lesions being unilateral, and because of the disturbance of the hearing and equilibrium, a diagnosis of labyrinthitis secondary to chronic tonsillitis was made, rather than an acoustic neuritis. The tonsils were removed. One year later the patient was again seen. He reported that his vertigo had disappeared soon after the removal of the tonsils, and that the hearing in the left ear had improved. Note the improvement in the tonal range; there was an improvement in the bone conduction, and the upper limit remains unchanged, as

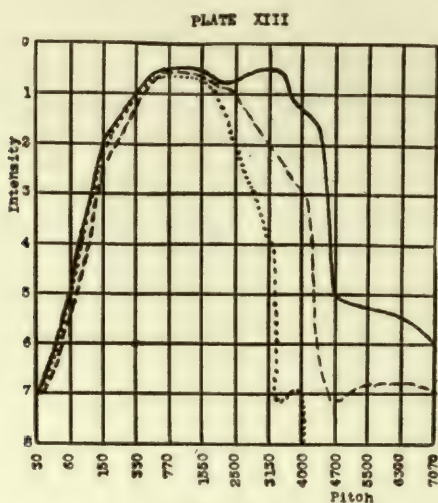


Fig. 13.

Dr. R. Age 23.

Date: October 16, 1920.

Rinne + each. B.C. —4 sec. each.

Forks	50 d.v.	c	c <sup>1</sup>	c <sup>2</sup>	c <sup>3</sup>	c <sup>4</sup>	c <sup>5</sup>
R	1/1	4/4	4/4	7/8	10/12	15/20	20/40
L	1/1	4/4	4/4	7/8	10/12	15/20	20/40

does also the power of hearing the c<sup>4</sup> and the c<sup>5</sup> fork. There was an improvement in the hearing of the c<sup>1</sup>, c<sup>2</sup>, and c<sup>3</sup> forks.

Fig. 13 shows the tonal range of a postinfluenzal acoustic neuritis. This patient presented himself in February, 1916, complaining of diplopia. A diagnosis of neuritis of one or more of the motor oculi nerves plus neuritis acustica bilateralis was made. The examination of the paranasal sinuses was negative. On November 20 the patient was again seen.

The ocular trouble had disappeared, the acoustic neuritis persisted. The tonsils were removed with no influence whatsoever upon the tonal range or the hearing.

Fig. 14 shows the curve of a boy aged eleven, of whose case we have made a diagnosis of hereditary neurolabyrinthitis. Note the typical tonal range; the higher notes as measured with the audiometer cut down; there is a tone gap. Bone conduction is decreased 10 seconds. Marked diminution for the 4096 d.v. fork.

PLATE XIV

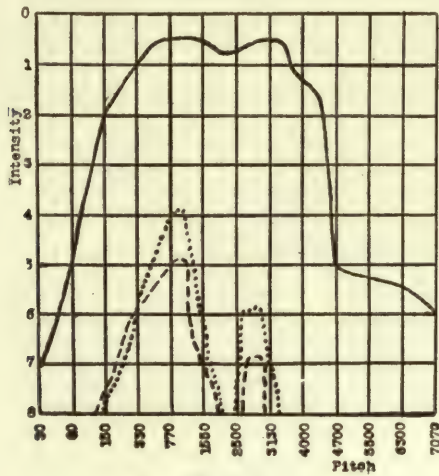


Fig. 14.

Mr. A. P. Age 11.

Diagnosis: Hereditary Neurolabyrinthitis.

Voice: R Wh. 0 Sp. 10 ft.

L Wh. 0. Sp. 10 ft.

Forks	50 d.v.	c	c <sup>1</sup>	c <sup>2</sup>	c <sup>3</sup>	c <sup>4</sup>	c <sup>5</sup>
R	4/4	7/8	8/12	12/24	10/36	4/48	2/60
L	4/4	7/8	8/12	12/24	5/36	4/48	0/60

Upper Limit

Galton R 16000 L 16000

Koenig R 32768 L 32768

Monochord A.C. R 14000 L 14000

B.C. R 17000 L 17000

Bone Conduction: —10 sec. each.

Fig. 15 shows the tonal range, tuning fork tests, the measurement of the upper limit, etc. for a brother of the case just shown.

Fig. 16 shows the tonal range, tuning fork tests, bone conduction and upper limit of a third member of the Powers family. These children have all been patients in our

clinic during previous years. The examination of their histories show that in each instance the diagnosis was neuro-labyrinthitis, cause unknown. Supposed foci of infection have been removed; treatment has been instituted without any effect on the progress of the deafness. The Wassermann tests of the father and children are negative. In each child the hearing began to fail apparently early in life, the parents noticing it first at the age of two or three years. In each

PLATE IV

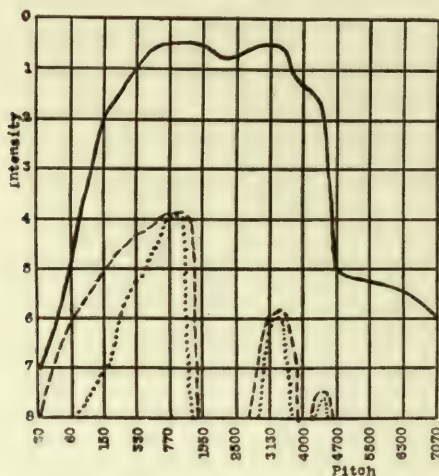


Fig. 15.

Mr. E. P. Age 16.

Diagnosis: Hereditary Neurolabyrinthitis.

Voice: R Whisper close to ear. Sp. 1 ft.

L Whisper close to ear. Sp. 1 ft.

Forks 50 d.v.	c	c <sup>1</sup>	c <sup>2</sup>	c <sup>3</sup>	c <sup>4</sup>	c <sup>5</sup>
R 2/4	4/8	6/12	12/24	0/36	0/48	0/60
L 2/4	5/8	6/12	12/24	0/36	0/48	0/60

Upper Limit

Galton R 14000 L 16000

Koenig D 27306 L 30720

Monochord A.C. R 13000 L 14000

B.C. R 13000 L 14000

Bone Conduction: —10 sec. each.

instance the loss of hearing has progressed very slowly. There are in this family seven children, all boys. Three of the seven are suffering from neurolabyrinthitis. There is no history of a similar defect affecting any of the ancestors, although the family history which we have secured is very poor. So far as we can ascertain there was no con-

sanguineous marriage. However, in similar instances where there has been a consanguinous marriage, we have had great difficulty in eliciting this fact. Our diagnosis is hereditary neurolabyrinthitis. This is the second family of this kind that we have studied. In the other family there were only four children, two girls and two boys. All four were hard of hearing. The diagnosis was neurolabyrinthitis. We were

PLATE XVI

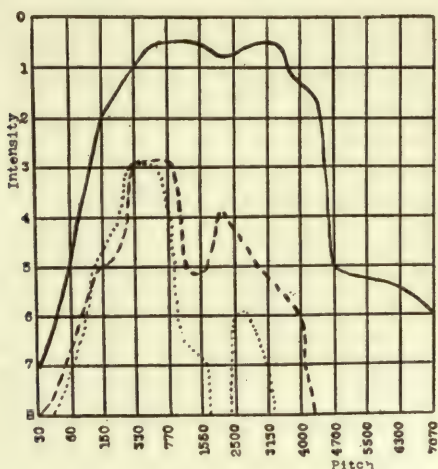


Fig. 16.

Mr. A. P. Age 8.

Diagnosis: Hereditary Neurolabyrinthitis.

Voice: R Wh. 1 ft. Sp. 20 ft.

L Wh. 8 in. Sp. 16 ft.

Forks 50 d.v.

	c	c <sup>1</sup>	c <sup>2</sup>	c <sup>3</sup>	c <sup>4</sup>	c <sup>5</sup>	
R	4/4	8/8	11/12	22/24	20/36	30/48	10/60
L	4/4	8/8	11/12	20/24	25/36	36/48	20/60

Upper Limit

Galton R 15500 L 14500

Koenig R 30720 L 30720

Monochord A.C. R 9000 L 9000

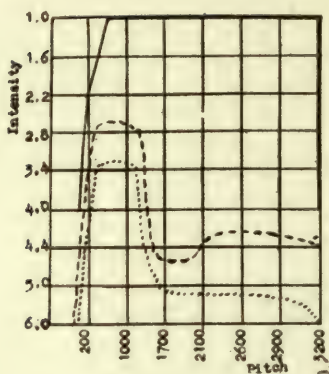
B.C. R 10000 L 10000

Bone Conduction: R -2 sec. L -3 sec.

able to examine the two girls only. The mother was hard of hearing, apparently from the same trouble. The mother's father also suffered from deafness. In the girls deafness began before 4 years of age.

Fig. 17 shows the curves of the two girls examined, made with the old audiometer. Their upper limits were markedly decreased; bone conduction decreased in one case

## PLATE XVII



Miss A. B. Age 14.

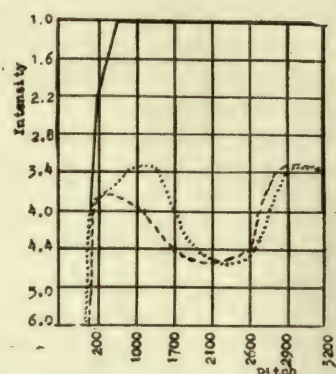


Fig. 17.

Miss R. B. Age 15.

## PLATE XVIII.

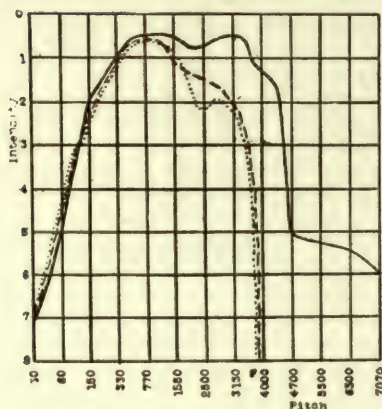
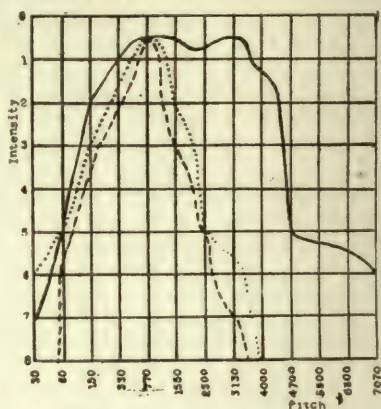
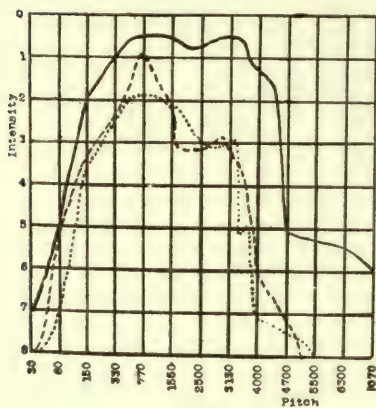
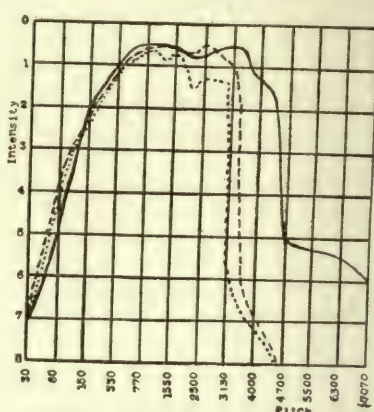
Mr. W. S. Age 26.  
Cause: Diseased Tonsils.Mr. J. T. Age 47.  
Cause: Cerebrospinal Syphilis.Mrs. M. B. Age 50.  
Cause: Cerebrospinal Syphilis.Mr. S. Age 30.  
Cause: Diseased Tonsils.

Fig. 18. Diagnosis: Acoustic Neuritis.

5 seconds, in another 8 seconds. In both of these patients the lower forks were heard normally, but the ability to hear the higher forks was markedly decreased. This series was studied in 1918. At that time we made a diagnosis of hereditary neurolabyrinthitis.

Fig 18 shows the tonal ranges as measured with the audio-

PLATE XIX

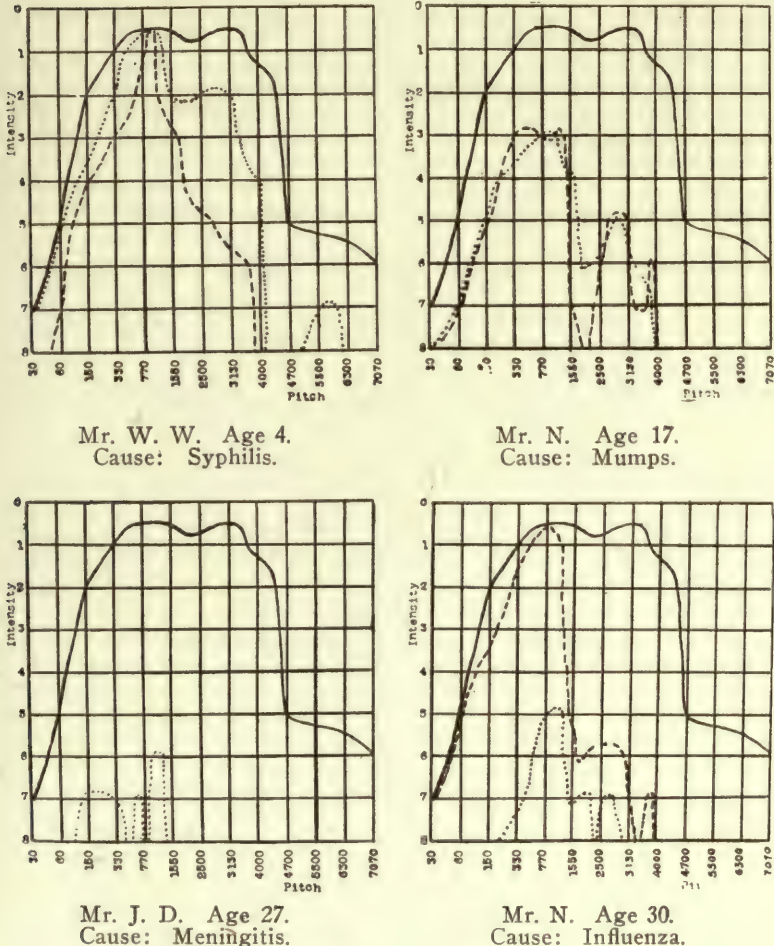


Fig. 19. Diagnosis: Neurolabyrinthitis.

meter for four cases of acoustic neuritis; two cases being due to chronic tonsillitis, two to cerebrospinal syphilis. This type of curve is always suggestive of acoustic neuritis.

Note the normal audition for notes in the lower part of the range of the audiometer, and the greatly diminished audition for notes of 3000 to 7070. Audition for notes of 500 d.v. to 3000 d.v., the range of the human voice, is in two of the cases normal, so there was no interference with the power of hearing ordinary conversation.

Fig. 19 shows the tonal ranges as measured with the

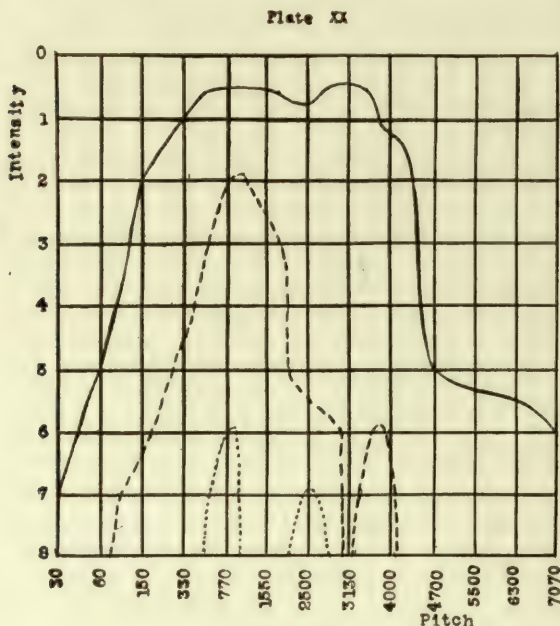


Fig. 20.

Monochord A.C. R 7000 L 7000  
B.C. R 14000 L 12000

Mr. Wm. E. Age 60.

Diagnosis: Leukemic Deafness.

Voice: R Wh. 8 ft. Sp. 45 ft.

L Wh. 0 ft. Sp. Loud voice close to ear.

Forks 50 d.v.	c	c <sup>1</sup>	c <sup>2</sup>	c <sup>3</sup>	c <sup>4</sup>	c <sup>5</sup>
R	1/4	2/8	2/16	12/24	10/36	30/48
L	0	0	0/16	0/24	0	0/48

Upper Limit

Galton	R 12000	L 10500
Koenig	R 27306	L 27306

audiometer of four cases of neurolabyrinthitis; one due to syphilis; one to mumps; one to meningitis and one to influenza. Note the presence of tone gaps. These curves with gaps are suggestive of neurolabyrinthitis and of otosclerosis.

They are, however, present in the curves of acoustic neuritis and of lesions of the cochlea secondary to middle ear disease. No curve is characteristic of any disease. The curves, however, frequently suggest the diagnosis.

Fig. 20 shows the tonal range of a case of leukemic deafness. These tone gaps are probably due to hemorrhages or exudates in the cochlea.

## PLATE XXI

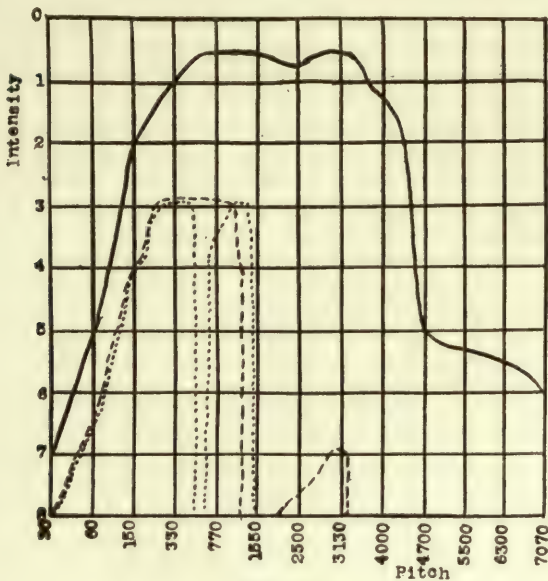


Fig. 21.

Mr. S. H. Age 63.

Diagnosis: Neurolabyrinthitis from Pellagra.

Voice: R Wh. 6 in. Sp. 2 ft.

L Wh. 6 in. Sp. 6 ft.

Upper Limit

Galton R 14000 L 14000

Koenig R 30720 L 30720

Monochord A.C. R 14000 L 13000

B.C. R 14000 L 15000

This curve suggests the influence of metabolic disturbances on the organ of hearing.

Fig. 21 is a very interesting curve because it shows the curve of a case of neurolabyrinthitis due to pellagra. It is very interesting as it illustrates the influence a disease which is supposed to be a pure metabolic disturbance can have upon the cochlear function.

## DISCUSSION.

DR. VIRGINIUS DABNEY, Washington, D. C.: To determine the lowering of the upper limit of hearing is no longer of academic or laboratory interest, but it is of distinctly practical use, in that it serves as a diagnostic means of importance showing a lesion of the nerve, or, more exactly, within the acoustic labyrinth. The marked shortening of bone conduction in syphilis is a well recognized means of diagnosis. In fact, it is often the only means of knowing that the patient has syphilis. This is one of the conclusions of Doctor Dean and Mr. Bunch.

The well established fact that the end organ of hearing responds more readily to those vibrations furnished by the voice would seem to suggest a more extensive use of it for hearing tests. For obvious reasons, however, it will not serve for differentiation of tonal limits, as the human voice differs so widely in different individuals and in the same individual under different circumstances. We are, therefore, forced to use a means that is not subject to such variations, and instruments offer the only method to obtain such results.

It is my belief that the structure of the internal ear is such as to cause physiologic differences in individuals whose ears do not seem to differ in ordinary use, a belief that is borne out in the charts and experiments shown to-day. This explains why some persons seem actually distressed by certain high musical notes, whether instrumental or vocal. I knew a man of great cultivation who experienced actual pain on hearing such sounds, especially the "E" string of the violin. His ears were perfectly normal otherwise.

The lowering of the upper limit of hearing in the aged is rightly considered by Doctor Dean and Mr. Bunch as not due merely to senile changes, but to newer lesions. This change is seen in youth, due to early arteriosclerosis, or to leukemia, though I have known cases where the entire disturbance of the acoustic and static labyrinth was due to simple primary anemia.

The influence of infection in causing a labyrinthitis must be conceded, whether the focus be tonsils, teeth, or even a chronic suppurative otitis. To this list must be added the infectious diseases and even those metabolic diseases, such as the case of pellagra reported. It occurs to me that the severe anemia which complicates such disorders may be the explanation. It may be of interest to add my own observation of the effect of excessive use of tobacco and even the mild use of alcohol, which I have frequently found affected the acuity of the hearing function in patients. Of course the effect on vision has long been known.

Dr. Dean and Mr. Bunch are to be felicitated on this valuable work, which is original in many of its aspects and conclusions. Their methods are sane, their conclusions conservative, and their persistence in this painstaking, onerous series of experiments is most commendable and should be of great assistance to all otologists who take their work and their patients' interests seriously.

DR. ROBERT SONNENSCHNEIN, Chicago: The introduction of the audiometer is a tremendous advance, but I fear it will be some time before it will be possible to use it in the ordinary office practice. At present it is an apparatus to be used in the laboratory and by men who thoroughly understand the mechanics thereof.

I wish to corroborate what Doctor Dean has said as to the Galton whistle varying greatly both as to pitch and intensity. It is absolutely impossible by means of ordinary strength of hand to set the Galton whistle at zero and still produce an appreciable tone. It would require a machine to produce enough air pressure to do so. Therefore it is necessary to set it beyond zero and that does not give you all the tones.

The point the Doctor has made of the change in hearing of high tones during acute middle ear disease, I think all of us have noticed. Perhaps it is by way of the round window during the middle ear disease that the labyrinth becomes involved.

Doctor Dean also emphasized the objective testing of patients instead of the comparative, finding out the duration of vibration of your forks and using that as the standard in determining the patient's acuity of hearing.

DR. JOHN GUTTMAN, New York City: I believe there is some confusion existing on this question. In every perception of a note we distinguish in the main two factors. One is the pitch and the other is the intensity. We must keep these separate. The examination of hearing has been compared to examination of vision. In examining the vision we are not only examining whether the defective vision is due to cornea, the lens or the nerve. We do more than that—we try to decide how far that diminution in sight goes. Why should we not also pay greater attention to the fact of how much the intensity in hearing is diminished? For examination of the quality of the sound we have a fairly reliable mode of examination in the tuning fork, although as was pointed out by several speakers, even these most excellent instruments may be unreliable for an exact examination. For examination of the intensity of the sound, Dr. Dean is one of the pioneers in this country in devising his new method for examination. I would like to ask Doctor Dean one question. Is he satisfied with the use of his instrument for the examination of the intensity of sound? The quality of the sound we can examine with tuning forks; but is he satisfied with his instrument in making a diagnosis as to intensity without using any other means? In other words, is his instrument exact enough? If it is not exact enough, why should we add to our armamentarium of inexact instruments another instrument which is not exact?

I work in the same line, and I devised an instrument which I showed several months ago before the Academy of New York, and I laid stress mainly upon the importance of examining the intensity and examining it exactly. We cannot do this absolutely, as there is a factor which we cannot control, that is, the mental concentration; the other factors which are essential in measuring the exactness of the intensity of the sound we should be able to control.

DR. L. W. DEAN, closing: The question has been asked whether or not we are satisfied with the audiometer and the tests made by it. We are not satisfied to-day with the apparatus at hand for the functional testing of cochlear function. We are working with the hope that better apparatus for this purpose will be produced.

Regarding the standardization of the methods for testing cochlear function, I am of the opinion that a large part of the problem is that

of standardization of the tuning forks used. It is very difficult to get a tuning fork without having a large number of overtones. Every fork will have some overtones. The most perfect fork from a scientific standpoint develops an excess of overtones if it rusts a little, or if it is handled without being polished afterwards.

I do not think we should make our tests with the most scientific forks. I shall be glad when we have determined what constitutes the proper standardization of a fork for our practical purpose. That is, what type of fork will be sufficiently accurate for clinical work.

# OBSERVATIONS ON LATERAL SINUS THROMBOSIS FOLLOWING MASTOIDITIS, WITH REPORT OF CASES.

JOHN MCCOY, M.D.

NEW YORK CITY.

The writer wishes to report three cases of sinus thrombosis and jugular resection following mastoiditis, which present points of unusual interest. They are chosen from a series of eleven cases, which occurred in our service during the past winter at the New York Eye and Ear Infirmary.

In one of these cases there arose the question of tying off or resecting the jugular vein of the right side, two years after the jugular vein of the left side had been resected for sinus thrombosis. This led us to a critical study of the collateral circulation, which must be established after such a procedure has been performed. As a result of this study, it was concluded that the external jugular vein plays an important part in the return circulation under these circumstances. In other words the venous blood is returned in the following ways.

1. Through the occipital sinuses to the vertebral plexus and then into the vertebral veins.
2. From the vertebral plexus into the pterygoid plexus and then through the external jugular vein.
3. From the cavernous sinus through the Vesalian vein, then through the external jugular vein.
4. From the lateral sinus through the condyloid veins to the vertebral plexus.
5. Through the ophthalmic and angular veins to the facial veins and then, the common trunk of the facial being tied off, to the external jugular vein.
6. From the superior longitudinal sinus to the parietal emissary veins, thence through the occipital and external jugular vein.
7. Through the foramen cecum to the nasal plexus, then to the pterygoid plexus, then to the external jugular vein.
8. Through the emissary veins of the diploe to the external jugular vein.
9. From the cavernous sinus to the internal carotid plexus, then to the pterygoid plexus, thence to the external jugular vein.

The writer would therefore urge that in the resection or tying off of the internal jugular vein, it is of importance to preserve the external jugular vein as a means of giving better collateral circulation, and particularly is it more important should the contingency arise of resecting the internal jugular vein of the opposite side at the subsequent operation. The detailed history of this case is as follows:

Israel G—— age nine years, was admitted to the hospital on March 2nd, 1921. He gave the following history. In June, 1919 he had a mastoidectomy performed on the left side at the Post-Graduate Hospital. Three weeks later he had an operation for sinus thrombosis and jugular resection on my service at the New York Eye and Ear Infirmary. His present trouble started in the right ear on February 26th, 1921, when he began with pain in this ear, which was followed by a myringotomy two days later. Since then the discharge has been constant.

Examination of the canal showed pus discharge with marked sagging of the posterior canal wall.

An X-ray made on March 3rd showed an exceedingly cloudy pneumatic mastoid on the right side, with the sinus possibly a little forward but deep.

A smear from the canal showed a mixed infection of streptococci present. The urine was negative.

His right mastoid was operated on March 5th. The mastoid was found to contain free pus and granulations throughout. A large area of sinus was exposed at the knee. The wound was treated and dressed in the usual manner and the patient's conditions seemed to be good until on March 16th, eleven days later, when he had a jump in temperature to 104°.

A blood count made on that day showed hemoglobin 60%, red cells 3,680,000, white cells 17,000, small 3%, large 2%, trans. 0, poly. 67%, eosin 0, myel. 0.

He was given free catharsis and his temperature gradually dropped in three days to normal. He had another jump in temperature to 105 1/2° on March 20th, when a blood culture was taken and another blood count. The culture was negative after 24 hours. The blood count showed 4,400,000 red cells, 16,200 white cells, 14 1/2 small, 3 large, 1 trans., 81 poly., eosin 0, mast 0, myel. 0.

His temperature dropped to 102° that evening and the following day, March 21st, rose to 105 1/2°. A blood culture was again taken and showed 18 colonies of hemolytic strepto-

cocci after 24 hours. It was then decided to open the sinus and to be guided by the condition found in it as to our interference with the jugular vein. He was operated on March 22nd. The lateral and sigmoid sinuses were exposed. The sigmoid sinus was opened and a small mural clot was found. When pressure was relieved at the lower end of the sinus, free bleeding ensued. So it was decided not to interfere with the internal jugular vein. The temperature ran a zig zag septic course after this for one week, when it was decided to try the effect of transfusion. The boy's father was selected as donor, but owing to a mistake in the laboratory in grouping the father's blood, a very unexpected and nearly disastrous result occurred. The transfusion was very skillfully done by Dr. Stetson, who first removed 500 c.c. of the patient's blood. He then introduced 60 c.c. of the father's blood, when the boy showed unmistakable signs of anaphylactic shock. It began with severe pains in the abdomen followed by a severe chill, which lasted for one hour and a half. His heart action failed. His mucous membrane became blue, skin cold and clammy and he passed into unconsciousness. By the aid of heat, stimulants, and adrenalin he was gradually restored, and the following day Dr. Stetson gave him 800 c.c. of blood from a selected and properly classified donor. Following this he showed a marked and rapid improvement and progressed to an uninterrupted recovery.

Case No. 2. Louis F—, age 37 years, nationality Russian. Entered the hospital on the fifth of February, 1921, and gave the history of suppuration from the left ear for the past 15 years, with an acute exacerbation during the past 10 days. Examination of the left ear showed the canal filled with pus, the drum partly destroyed and tenderness over the mastoid. A radical mastoidectomy was performed on February 5th, 1921 by my assistants, Drs. Coleman and Walters. The patient apparently did well until about a week later, when his temperature became irregular and septic, ranging between 99° and 101°. Twelve days after the operation on February 17th, he had a sudden jump to 104°, when a blood culture was taken. This being doubtful, another culture was taken on the 18th, and this showed on the 19th, colonies of hemolytic streptococci. He was prepared for a lateral sinus and jugular operation. The operators decided to perform the latter procedure first. Accordingly they exposed and resected the internal jugular vein tying off its branches. At the end of this

step in the operation, the patient seemed to be in a very poor condition, and it was deemed wise to defer opening the lateral sinus for 24 or 48 hours. On the 21st his condition still remained poor, and it was decided to wait until the 22nd before instituting further operative procedure. On the 22nd he had a suspicious redness and boggiess all around the mastoid wound, which looked like erysipelas and which proved itself to be such. It is our custom at the hospital to transfer patients immediately to Bellevue Hospital, where they have a pavilion for erysipelas, and so this patient was transferred without having had his lateral sinus opened. He remained in Bellevue two weeks, during which time nothing but the surgical dressing of the mastoid wound and neck wound was done. He was discharged as cured of his erysipelas in two weeks, and returned to our clinic for surgical dressings. He progressed to an uninterrupted recovery without ever having had his lateral sinus operated upon.

Case No. 3. Nathan S—, age 44.

Entered the hospital January 11th, 1921. Gave a history of constant discharge from the left ear for the past three weeks. Also had moderate pain in and about the ear for three weeks. He complained of deficient hearing, tinnitus and vertigo.

Examination of the left ear showed a thick discharge in the canal and a marked sagging of the posterior-superior canal wall, with moderate tenderness on pressure over the mastoid.

A smear from the pus showed streptococci in long chains.

An X-ray of the mastoid revealed the left mastoid to be of pneumatic type but very cloudy, and the details were indistinct, with the sinus a little forward.

On January 13th a simple mastoid operation was performed. The mastoid contained free pus and granulations throughout. There was a large area of sinus covered with granulations exposed at the knee.

This patient ran along with an irregular temperature between 99° and 101° for eight days, when his temperature on January 21st rose to 104 1/2°. A blood culture was taken on the 22nd, and proved negative. His temperature still remaining high, another blood culture was taken on the 24th and proved negative; but a culture on January 26th showed 15 colonies of hemolytic streptococci. A blood count on the 22nd showed 4,500,000 red cells, 11,000 white cells, 33 1/2 small, 4 large, 5 trans., 61.5 polys., 5 eosin., mast. 0, myel. 0.

Blood count on January 24th: 4,500,000 red cells, 10,000 white cells, 30.5 small, 6 large, 1.5 trans., 62.5 poly., 0 eosin, 0 mast, 0 myel.

Crowe's Sign was tried on this patient. After 4 1/2 minutes he gave a positive reaction in that the veins of the forehead and of the left retina became distinctly engorged. This is the only case in our series in which we have been able to elicit this sign; but it is likewise the only case in which we have had a completely occluding clot, so that I believe it to be of value in that type of case.

The sinus was freely exposed, and on opening it an organized clot was found, which extended back one and one-half inches from the knee, when free bleeding was obtained. No bleeding could be obtained from the bulb end of the sinus. The neck was then opened for a jugular resection. When it was attempted to push the belly of the sternocleidomastoid muscle aside, it was discovered that the tissues of the neck were densely matted together, so that it was impossible to distinguish where the carotid sheath was. Also, strange as it may seem, the pulsation of the carotid could not be felt, so that we were compelled to hazard a guess as to where the carotid sheath might be. So, using the landmarks such as the hyoid bone and the large lymphatic gland, which usually lies directly upon the carotid sheath, we made our incision through this mass of fibrous tissue and were greatly pleased to find that we were right in the middle of the sheath, and our vessels then came into view. The jugular vein was completely thrombosed and collapsed as were also its tributaries, the superior thyroid, lingual and facial veins. They were ligated and resected. This patient progressed to an uninterrupted recovery.

The outstanding feature of this case was the difficulty in locating the carotid sheath. It represents a type which the writer has met several times, and which is difficult from a surgical standpoint.

#### DISCUSSION.

DR. SAMUEL KOPETSKY, New York City: It will be noticed that the three cases presented, with the possible exception of the second, were of the coalescent type of mastoiditis, where you have progression by continuity and involvement of the sinuses. It is in that type, once we recognize it and open it, that the infection in the blood vessels and the general system is not so severe that one is forced always to resect the jugular, as illustrated in the first and second cases. A study of the hemoglobin condition of the blood is of great importance. I have

had a series of 43 cases, in three of which we had to decide at sight upon which side to go in, and in those cases Crowe's sign was of no value. The sign might be due to an obliterating clot.

In regard to transfusion, I believe more patients can be saved by the direct transfusion of whole blood in these cases which show severe systemic infection than by any other treatment we have. An important factor, of course, is the immunity of the donor and the transfusion of immunized blood.

In regard to jugular resection, where the patient is run down and one wants to avoid the condition presented in the third case, where the patient went into collapse, the primary thing the patient suffers from is systemic infection, and the primary act is the separation of the general circulation from infection, and we accomplish that by a ligature thrown around the jugular vein. Then sustain your patient by transfusion before you do your work on the mastoid. If you have already performed the mastoid operation, you have only to open the vein, but I prefer in cases clearly diagnosed, with corroborative findings from the laboratory, to do the neck work first. In a few cases I made the transfusion, waited four hours, and then worked on the neck.

DR. B. V. RAYDIN, Evansville, Indiana: I wish to report a case of mastoiditis complicated by lateral sinus thrombosis and later by cerebral hernia.

On May 11, 1921, I was called to see Raymond H., age 10 who gave a history of earache for the past two days. Examination of ears disclosed a bulging, inflamed right tympanic membrane. After a paracentesis, the boy apparently did nicely under usual treatment until May 21, 1921, when the mother phoned that he had severe earache. I found him with a temperature of 104° and with all the indications of acute mastoiditis. He was brought into the city the following day, and a roentgenogram confirmed the diagnosis. His blood picture showed a leucocytosis of 18,400, with 82 per cent. of polys.; blood culture negative. The following morning a simple mastoidectomy was done. The mastoid process was found pneumatic, the cell walls very soft; antrum very deep and full of pus. The lateral sinus was found exposed and the wall grayish black, but it was not disturbed at this time. Smear from mastoid showed diplococci. Temperature 103° to 104° until the morning of the fifth day, when the boy had a severe chill lasting about 45 minutes and the temperature fell to normal, rising again to 104°.

From these findings we concluded we were now dealing with a case of right lateral sinus thrombosis. Dr. Hanau Loeb of St. Louis was called in consultation, and questioned the diagnosis on the simple fact that there had been only one chill. It was decided to operate that night, and on incising the sinus Dr. Loeb found it thrombosed. Curettment of the torticular end produced a free flow of blood which was easily controlled. The jugular vein was then ligated. Culture of the thrombus showed streptococcus hemolyticus, and of the blood the same organism.

About two weeks after the second operation, four sutures were placed in the mastoid wound as it was very large and gaping. That night he complained of severe pain throughout his head, and the sutures were removed, but with no relief, the condition continuing for four days.

Thorough elimination of the gastrointestinal tract gave him considerable relief from pain.

During the course of the convalescence, we noticed an elevation in the region of the obliterated sinus which appeared to us to be a cerebral hernia. This enlarged until it extended about 10 mm. above the level of the skin. A pulsating opening in the hernia finally developed, with a discharging secretion which proved to be cerebrospinal fluid. This we treated successfully with sterile pressure dressings; the flow of fluid ceased, and when I left for this meeting the hernia had decreased to about the size of a pea.

DR. JOHN MCCOY, New York City (closing): I wish to say only that a case of double sinus thrombosis struck me as a very unusual case. I have read of only two cases previously, and both had been ligated. I want to thank you for your kind attention.

## TOTAL BLINDNESS OF BOTH EYES CURED BY DRAINAGE OF SPHENOID AND ETHMOID CELLS.

JAMES JOSEPH KING, A.B., M.D.

NEW YORK CITY.

Consultant in Diseases of the Ear, Nose and Throat, French Hospital; Attending Laryngologist at the Hospital for the Ruptured and Crippled; Assistant Surgeon in Otology, New York Eye and Ear Infirmary.

Mrs. E. C., age 50, referred to me on January 27, 1921, with total blindness in the right eye believed by the ophthalmologist to be due to sphenoid and ethmoid disease.

PREVIOUS HISTORY. Had acute laryngitis with complete recovery. Tinnitus in right ear.

I am indebted to Dr. John J. Cotter, who treated her before I saw her, for the following notes.

November 4, 1920. Redness of Shrapnell's in long handle of the malleus. November 5, 1920: Free pus under right middle turbinate. Antra fair. November 20, 1920: Condition continued about the same. Free pus in right nasal chamber. Culture showed Friedlander's bacillus and many cocci. December 6, 1920: Local treatment to nose and administration of autogenous vaccine. This treatment was continued by Dr. Cotter until January 12, 1921.

January 25, 1921: She reports loss of vision in right eye, and was referred to Dr. A. S. Kelly, who gave the opinion that the blindness in the right eye was due to ethmoid and sphenoid disease.

She complained of headache over the frontal region for nearly a week. Occipital headache for the last few months. Tinnitus (roaring like the ocean) for four months. Vision nil in right eye since last night. Disturbance of vision in this eye for the last four days. Eye examination, January 27, 1921: R. E., pupil moderately dilated, immobile. No consensual reaction. Vision nil, not even perception of light. Fundus normal. Left eye, pupil reacts to light and accommodation normally. Vision 20/20. Media, membrane and fundus normal.

Radiograph of the sinuses by Dr. George S. Dixon was as follows:

"Frontal sinuses are well developed and clear. The right ethmoids and both antra are cloudy. The left ethmoids are

fairly clear. Her nasal septum is deviated to the left. The lateral plates show the ethmoidal and sphenoidal regions cloudy. Her sella is of liberal size but good form and without erosion."

Upon getting this report we decided to drain the right sphenoid and exenterate the right ethmoids. This was done on the evening of January 27.

The usual preoperative treatment of cleansing the nose was carried out. A simple exenteration of the anterior and posterior ethmoids was done, and the anterior-inferior wall of the sphenoid was removed.

Eye examination by Dr. A. S. Kelly, January 30, 1921. Right eye: Consensual reaction. No other change noted. No light perception.

Dr. Hunt reports negative for neurologic findings, but suggests a Wassermann test. Blood pressures systolic 110, diastolic 55.

February 1. Five days after operation. R. E. examination: Counts fingers at two and a half feet. Recognizes hand movements and identifies large articles in room. Pupil smaller but still immobile. Consensual reaction to light. The vision gradually improved in this right eye, until at the end of about two weeks she had 20/40 vision in it.

After the vision began to improve, about February 4 or 5, her blood test showed a four plus Wassermann. Antispecific treatment given. She received an injection of salvarsan about once a week, mercurial inunctions and saturated solution potassium iodid internally, beginning with 15 drops after each meal, and increasing the dosage one drop each time up to 75 drops.

About February 7 or 8 she complained of disturbance of vision in the left eye, and in a few days she had lost all vision in the left eye. By this time she had regained considerable vision in the right eye. We thought by this time that it was probably due, in view of the four plus Wassermann, to syphilis. She had then had two or three salvarsan injections, the mercurial inunctions, and the potassium iodid. Notwithstanding the fact that the vision in the right eye had cleared up after the nasal operation from nil to 20/40, we waited one week after the left eye became totally blind, expecting the antispecific treatment to clear it up. At the end of a week there was no improvement in the vision in this left eye. She was totally blind in it. I then opened up the sinuses on the

left side, as I had done on the right side. The only significant thing in the operation was that bare bone was felt on the outer wall of sphenoid. From this operation she made an uneventful recovery.

This left side was operated upon on February 16, and she left the hospital on February 19. I have not seen her since, but I have been informed by Dr. Kelly that she has 20/40 vision in each eye.

I report this case as it occurred and you can draw your own conclusions as to its diagnosis.

Our conclusions are:

1. That in sinus disease affecting the vision, operation must be done early if sight is to be restored.
2. Where the case is complicated by a positive Wassermann, treat the specific condition and at the same time treat it just as though syphilis were not present.

#### DISCUSSION.

DR. JOHN MCCOY, New York City: This is a very interesting case and I think Doctor King is justified in his conclusions. The question which concerns us as rhinologists is, when these cases are brought to us by the ophthalmologist, are we justified in destroying the ethmoidal and sphenoidal labyrinth? The answer to that question can be obtained only by both working together. These cases are due to toxic neuritis, or to septic pressure neuritis. If they are due to the first, we must be sure that the toxemia is emanating from the accessory sinuses and not from the tonsils, teeth, or from infection elsewhere in the body. There have been so many of these cases reported with such brilliant results, that it would seem that the ethmoid and sphenoid are in danger of extinction as are the tonsils.

I saw a case of this type in consultation, and it presented some very interesting points. A boy, about sixteen or seventeen, complained of blindness in the left eye. I do not remember whether it was total or partial. He was examined by an ophthalmologist who took him to a rhinologist and they concluded the trouble was in his ethmoids and sphenoid. An exenteration of the sphenoid was done with the result that in forty-eight hours the boy's vision completely returned. He ran along feeling very well for two or three months, and then again became blind. The sphenoid was curetted with comparatively no effect, and the next step to be considered was the complete removal of the anterior ethmoid cells by external operation. In doing so, for the sake of cosmetic result, a very small incision was made on the outside, and the anterior ethmoidal cells entered and curetted. This resulted in a return of his vision, but about ten days later the vision was completely lost. Then he was subjected to a modified radical frontal operation. This operation gave him relief for about ten days, and then again his vision was lost. At this time I was called in and asked my opinion. I believed this result was because they wished to obtain a wonderful cos-

metic result rather than complete surgical drainage. In the first place, I think the incision for the ethmoid was too small and the operation did not remove the entire ethmoid labyrinth. The result was that the drainage from his frontal sinus was insufficient, and these small cells produced a pressure neuritis. Eventually he was reoperated, a complete radical frontal was done, and the boy made a complete recovery.

DR. GEORGE F. KEIPER, Lafayette, Indiana: I can almost duplicate the case of Doctor King, with this exception, that after I had made an opening of this kind for relief of blindness, I also resorted to suction.

If there was any mistake made in the reading of this paper, it is that it was not read before the general session so that all the men might have heard it. I can look back and see cases that I believe we could have cured of blindness, if we had had sense enough to open up structures in the nose that were producing the trouble. The lesson that comes home to us here is this: we ophthalmologists must also be rhinologists, we must also be otologists.

When a patient comes to us with loss of vision, of course the very first thing to do is to have an X-ray plate made in order to see just what the condition may be in the sinuses and the nose, and if it shows something wrong, I would suggest first of all to try suction, and if suction fails—and it will sometimes—then it is time to go in and open up the ethmoid cells that may be the cause of this trouble.

DR. H. V. DUTROW, Dayton, Ohio: I do not wish to deprecate the advantage of intranasal surgery in these cases, but the thought occurred to me in this case as reported by Doctor King, that there might be a possibility of invasion of the optic nerve sheath by the spirocheta pallida. I think the ethmoiditis might be regarded as a coincidence, but I would not like to feel that, in every case similar to this where we have a 4 plus positive Wassermann, the cause of blindness was due entirely to the nasal condition.

DR. A. H. ANDREWS, Chicago: Two points in this case I wish to emphasize. One is that not all cases of sudden blindness are due to a condition of the nose, nor are they due to syphilis. There are a good many cases of hysteric blindness, which may occur in the presence of some real or supposed pathology in the nose, and may lead to unnecessary surgery.

The other point is that if blindness is due to intranasal conditions, the sooner it is relieved the better for your patient. In one of my cases, it was ten days before the sphenoid was cleaned out and the vision never returned to normal; it became only sufficient to enable the patient to go around.

DR. JAMES J. KING (closing): In closing I want to speak only of the point brought out by Doctor Andrews. We carefully considered hysteric blindness in this case, and the ophthalmologist and practically all the eye men in the New York Eye and Ear Infirmary saw this patient, and were very much interested. She told me eight doctors, had been to see her, and she was carefully gone over by the eye men, and hysteric blindness was ruled out by them. I cannot vouch for it myself, because I could not recognize hysteric blindness if I saw it; but it was ruled out by eminent eye surgeons in New York City.

In regard to the point Doctor Dutrow brought up, I have noticed

that very thing and therefore my conclusions. You can draw your own conclusion. The facts have been presented, and my conclusions are that if you are to save the sight in these blind eyes by sinus operation, you must do it early. If you do not operate early, the operation will not have any effect on the vision. The second conclusion is as stated—if we find a 4 plus Wassermann in these cases, give them specific treatment, and at the same time do everything for the patient that you would do if the specific condition were not present. I think many times specific patients are not given the advantage of methods which are applied to other patients. Therefore my conclusions as stated.

## THE MOURE OPERATION FOR REMOVAL OF LARGE GROWTHS AND FOREIGN BODIES FROM THE ANTRUM.

VIRGINIUS DABNEY, M.D.

WASHINGTON, D. C.

Those of us who had the pleasure and profit of studying in the clinics of Germany and Austria in those halcyon days before the Great War will doubtless recall how aghast we sometimes were at the operative procedures we witnessed there, which seemed to take no account of cosmetic results and to ignore the comfort and convenience of the victims. Thus, the operation of lateral rhinotomy which Moure developed and really devised, would appear to be a mutilating and bloody procedure, whereas, properly performed, it is neither the former nor especially the latter. It is due to the boldness of conception and skill of performance, associated with an intimate knowledge of the special anatomy involved, that such operative methods are devised and are successful in their performance.

The especial place for this operation is where the naris is crowded with neoplasms, either benign or malignant, single or multiple, which are evidently overflowing from the antrum, though there are usually in addition independent foci in the ethmoid and even sphenoid; and, moreover, where repeated removal through intranasal methods has proved futile in preventing recurrence. Usually deformity and dislocation of the eye, cheek and nose, especially the eye, occur before the extensive nature of the disease suggests itself to the attendant, or patient. The reason for this is that the accumulation in the open naris does not cause the deformity as a rule, but that in the interior of the antrum does. Thus, while the growths are being removed carefully and thoroughly from the open cavity of the nose, those in the antrum continue to grow and their pressure increases, despite the intranasal work, till the cheek, eye and even the roof of the mouth show the characteristic deformity of great and unrelieved pressure.

The technic which I employ is essentially that of Moure, aside from those minor details which every surgeon is apt to exhibit, such as the control of hemorrhage, the use of retractors and the postoperative care. Argyrol is first instilled in the eye of the operative side, the face is then painted with tinctur of iodine,

which is immediately removed with alcohol, and the eye covered with a pad wrung dry from a bichlorid solution. The usual towels are draped over the head and neck to cover all but the part to be attacked. A curved incision is made, parallel with and  $1/8$  inch below the infraorbital margin, beginning at and below the outer canthus and extending to a little below the inner canthus. From this point it is carried straight down, along the juncture of the nasal ala and the face to the edge of the nasolabial junction. The bleeding is, of course, brisk and must be controlled as the incision is lengthened, step by step, as the blood will completely obscure the field and prove very embarrassing unless so arrested. Having secured a practically dry field, the periosteum is now elevated, and it must be done with the utmost care and thoroughness, avoiding not only tears but also leaving in situ any of its extent. Upon this seemingly unimportant detail depends at least half of the success of the surgeon's attempts to secure a good cosmetic result. In order to prevent bruising of the parts and the possible formation of slough, it is important at this stage to remove all artery clamps where they can be dispensed with, and to retract this roughly triangular flap with a loop of silk run through the apex of the tissues, not with metal retractors, in other words. Here, again, an effort is made to insure primary union of the soft parts for reasons previously stated. The ala of the nose is now elevated and access gained to the nasal bone and the nasal process of the superior maxilla, and all hemorrhage controlled. Before proceeding with exposure of the interior of the antrum and naris, the posterior nares is packed and the use begun by the anesthetist of an aspirator such as is used in tonsil operations. This instrument must be kept continuously in the throat to catch any blood that may escape through or around the nasal packing till all the growths have been removed, the hemorrhage controlled and the general cavity packed. The separation of these masses, especially when malignant, is attended generally by profuse flow of blood which, of necessity, would proceed down the rhinopharynx and into the trachea, unless preventive measures had been taken well in advance. Even so, it is at times necessary to renew the packing because of its becoming saturated with blood. With a square edged chisel, a section of bone is now marked out corresponding in extent and contour with the skin flap, but with this additional area: the posterior half of the nasal bone and so much of the nasal process as may be necessary to allow free inspection of the interior of the nose and the ethmoid. When this area marked out by the chisel

has been broken out with suitable forceps, there lies before the eye the entire interior of the antrum and nose, easily accessible to any instrumentation that may be required by the special necessities of the case. No other method will so reveal this general cavity, or even if attempted, will do so with such safety and thoroughness. It is now an easy matter to remove all growths from their numerous attachments, either in nose or antrum, and I personally prefer the finger where possible, supplemented by curettement of the entire surface and removal of all tags and shreds with any grasping forceps, my preference being the Luc. After packing with gauze impregnated with Dakin oil solution, the wound is sewed up in two layers, care being taken in approximating the skin edges. The end of the packing is pulled down to the edge of the nostril, where it is readily found on the third day for removal, and an ice bag kept on the cheek continuously for two days. In the absence of malignancy, or much foul discharge, a repacking is not usually necessary, though this can be done if the attendant wishes, as the nostril offers all the room necessary for it and for free inspection. Gentle, warm saline irrigation two or three times daily is usually all the after care that is required in benign cases. However, in the presence of malignancy, the wound cannot be closed, but must be left open and treated as any other open wound, and the use of the X-ray and radium persisted in. With this exception, generally there is no depression or deformity in the face; in fact, where primary union takes place the scar is hardly visible.

The removal of foreign bodies by the route of this operation is essentially the same as described for that of neoplasms, though the interior of the nose may not require exposure, and, in this event, the removal of the bony flap involving the nasal bone and the nasal process may be omitted. However, it will still be necessary to elevate the nasal ala and push it aside to give sufficient room for manipulation of the rest of the flap. Foreign bodies gain entrance into the antrum and nose as the results of industrial accidents, such as the breaking of a flywheel or other revolving and rapidly moving mechanical devices, with the breaking loose of steel masses, striking a patient in the cheek and nose. Also, during the war, instances were numerous where projectiles in whole or in part found their way into the antrum. In this latter type of injury the skin incision must take into account the wound of entrance and will accordingly depart from the classical incision described here. For instance: there came into my hands a soldier who had received a piece of shell casing just below the

malar bone, which had made its way into and through the antrum, emerging through the hard palate. However, in its journey it had split, leaving half of its bulk in the antrum. Here, obviously, the thing to do was to follow the wound already made, and the base of the triangle was reversed, being at the infraorbital margin, and the shape of the incision was more crescentic than triangular, including the nasal incision within its curve. This young man had had for years an empyema of that antrum, which was permanently cleared up as an incident of the operation for removal of the fragment of shell casing.

To anyone who has done war surgery, and to plastic surgeons whose extraordinary achievements during the war are well known, this operation is almost absurdly easy, but it was not given to all of us to have such experience, and thus the Moure operation as a means of creating and approaching the joint cavity of antrum-nose-ethmoid should be kept in mind, and a description is not out of place for the rhinologist.

Rather than giving the arid details of cases, I will describe only one, especially as this patient had the rare and somewhat undesirable experience of having both sides operated, the second operation involving the frontal sinus as well as those usually affected.

A colored boy, 19 years of age, desired relief for nasal stoppage of the right side, and examination revealed complete blocking of that side with numerous greyish polyps, and perhaps slight bulging of the antral wall anteriorly. Repeated removal of these growths gave no permanent relief, as they reformed rapidly, and the antral wall gradually bulged forward, but this was the only deformity noticeable. A radiograph showed marked density, and another rhinologist performed the classical Moure operation, at which I happened to assist. The interior was crowded with slippery growths found subsequently to be fibromyxomata, but the skin incision did not hold very well, and there was slight depression of the scar, the patient remaining in the hospital several weeks. A year and a half later he returned and fell into my hands. At this time the right naris was free of growths, but the left was now full as in the first instance, the cheek bulging, the eye prominent downward and forward, causing the so-called "frog face." He complained not only of difficulty in nasal respiration but also of headache referred to the brow and vertex. The radiograph showed, of course, equal density on both sides, but as I was familiar with the history of the case, I at once operated and found a characteristic condition, antrum,

ethmoid and nose crowded with fibromyxomata. However, as the brow was distinctly soft and bulging and the orbital plate completely destroyed, I made an incision in the hair line which joined the other incision at the canthus, and removed the anterior frontal wall, finding the entire floor of the sinus gone and the upper third of the globe of the eye well within the frontal sinus limits. There was obliteration of the anterior ethmoid, so there was already ample drainage into the nose. Thus, the frontal sinus, naris and antrum were thrown into a common cavity, and the frontal and facial wounds healed by first intention, the patient leaving the hospital in a week with no scar visible. Three weeks later, he returned showing a break in the wound in the center of the cheek, but this healed in a few days and did not mar the cosmetic effect in any way.

Eight months after this visit the condition was still good with no return on the left, but on the right, the side first operated, there was a return of the growths, though he appeared well and was not in especial discomfort from this accumulation. He has not returned now for a period of two years.

This operation appeals to me for its safety, rapidity of convalescence and absolute certainty of removal of all growths and diseased tissue. Nothing can take the place of the ability on the part of the operator to see what he is doing and what the conditions require him to do. Such desiderata cannot be obtained so well, if at all, by any other method of relieving the condition for which the Moure operation is devised and properly applied.

# A NEW SURGICAL TECHNIC FOR THE OPERATIVE AND POSTOPERATIVE TREATMENT OF MAXILLARY SINUS DISEASE.†

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There has been little change in the surgery of the antrum since the historic papers of Caldwell<sup>1</sup> and Luc<sup>2</sup>, almost three decades ago. The various modifications of the operation described by Caldwell in 1893 all have the same principle underlying them, viz., that after the pathologic condition of the antrum has been surgically dealt with and the nasal opening obtained, the oral opening should be promptly closed.\* It seems to me that some change in surgical technic is necessary to meet the requirements of the present understanding of the pathology of the antrum and of the importance of its low grade, obscure infections causing general systemic infection, manifesting itself in ear pathology, headaches, cardiovascular, nephritic and nervous conditions.

Often in these conditions the patients are very weak and nervous. Any local operation has so many terrors to them, that they are quite unable to bring themselves to undertake it. In addition, any procedure would be dangerous which might transform an old latent infection into an active acute supuration. It is to meet these two conditions that I have devised the present technic. The use of a general anesthetic removes the fear of pain, and constant irrigation prevents active infection and absorption.

For several years I have felt that the early closing of the oral opening was undesirable, because through it the antrum is much more accessible to postoperative treatment

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\*"The frequency with which sinus disease is recognized is in proportion to the care with which the sinuses are explored."

"My own method in these cases has been to make a large temporary opening in the canine fossa through which the antrum is thoroughly cleansed. A large counter opening is then made into the inferior meatus and the primary opening closed. All subsequent irrigation, drainage and medication is conducted through the opening in the inferior meatus. By this method I have secured the best results with the minimum of inconvenience to the patient." Caldwell, loc. cit.

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and it is this surgical after treatment which I wish to emphasize.

The following technic has the advantage which Caldwell's operation, as originally given by him, has of conservation of the greater part of the nasal wall and of the antrum mucous membrane. This is applicable to all latent and most empyema cases. It is not desirable in marked bony necrosis with sequestra.

**TECHNIC.** The whole aim of the surgical treatment of antrum diseases as given in most works is drainage. While efficient and permanent drainage in a retention empyema produces such marked improvement that the case is considered cured, in most low grade infections, and in many active infections, much more than mere drainage is necessary to bring about a return to normal. Many cases show on operation two conditions: (1) a chronic diseased and thickened mucous membrane (Fig. 1) and (2) either a marked softening or hardening of the nasal and anterior walls (Fig. 2), especially noticeable in the thicker anterior wall. This change in the bone, found on operating on the anterior and median walls, undoubtedly extends to all walls of the antrum, but as the other walls are not interfered with in the operation their condition cannot be demonstrated.

Many of these antrums are draining quite freely into the nose before any operation is performed, and the natural openings seem quite patulous to the escape of secretions. The mucous membrane is pyogenic, however, and needs thorough treatment. It is for this reason that this operation and technic is devised, and that constant through and through washing is used for cleansing. Any method that provides thorough and constant cleansing will bring about resolution.

Ether anesthesia by the open method is used to commence narcosis. As soon as the operation begins, it is necessary to have some form of ether blower and suction apparatus. I find the long suction point used in tonsil work very useful for the administration of the ether as it carries the ether well back into the mouth. A retractor is used on the upper lip (Fig. 4), and an incision about one inch long is made at the junction of the gingival and buccal mucous membrane, well above the roots of the bicuspid and cuspid. (Figs. 3 and 4).

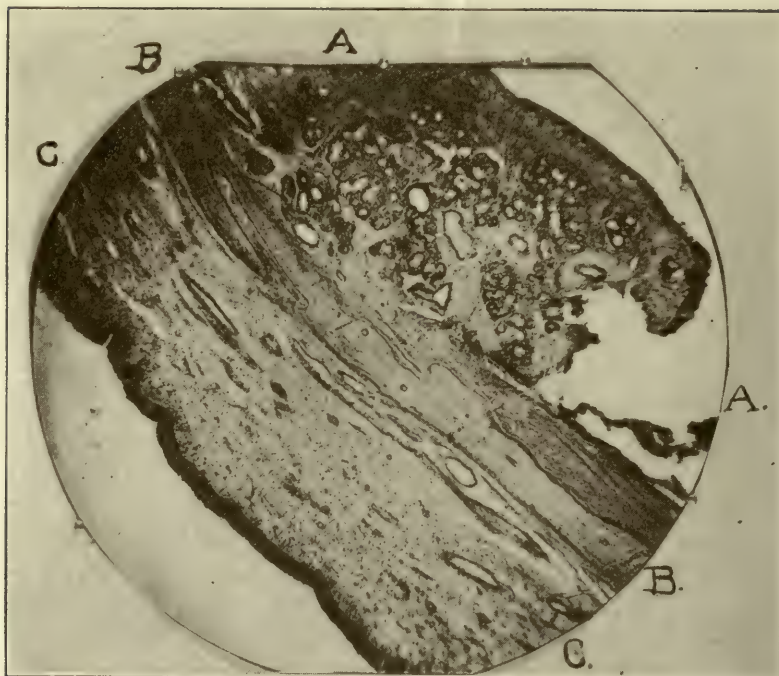


Fig. 1. Microphotograph of nasal wall from a case of latent maxillary antrum disease, showing (A) greatly hypertrophied nasal mucous membrane, (B) bony nasal wall with invasion of fibrous tissue and (C) greatly hypertrophied mucous membrane of antrum.

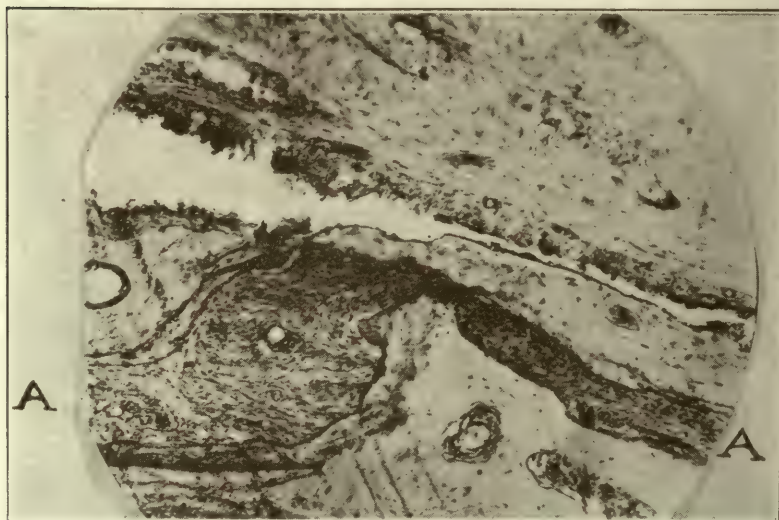


Fig. 2. Microphotograph of anterior wall (canine fossa) from a case of latent antrum disease, showing invasion of bone by fibrous tissue, A A.

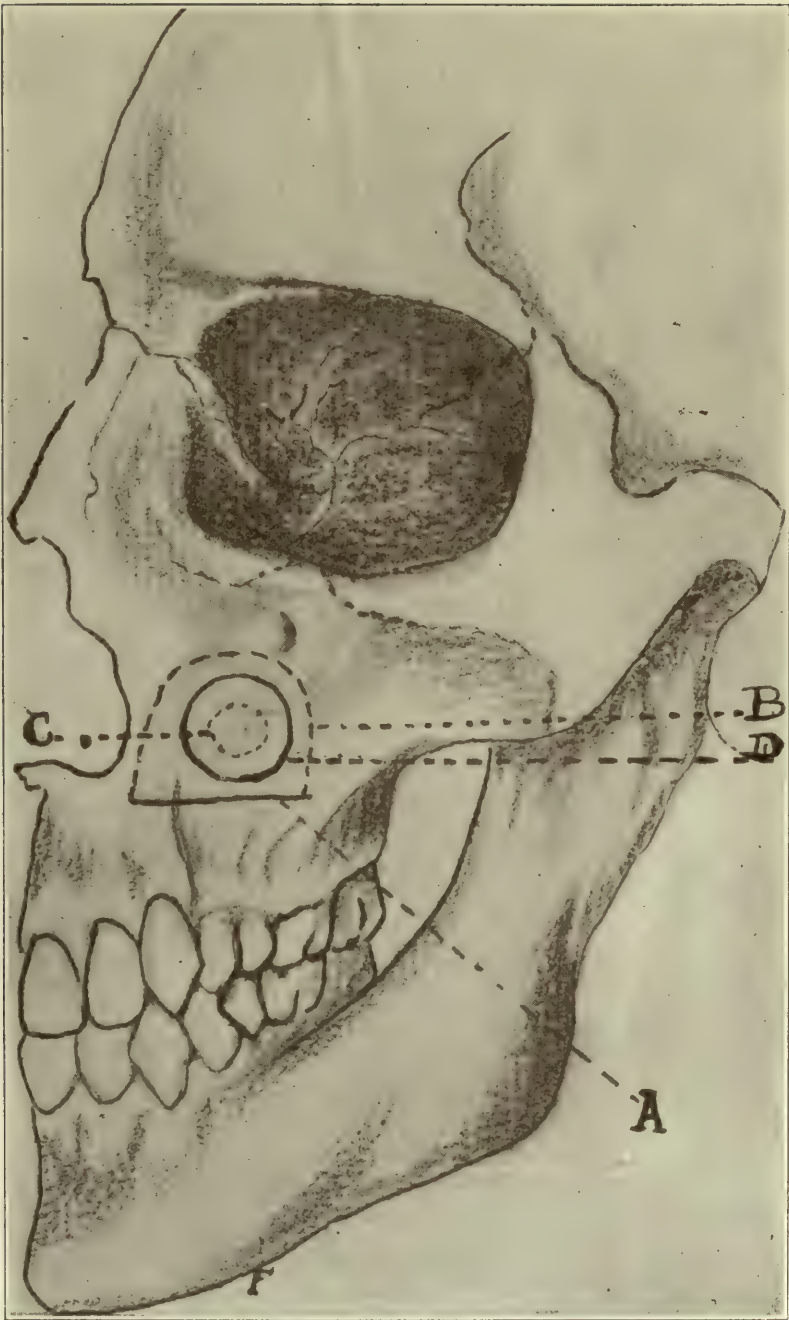


Fig. 3. (Actual size). Skull showing position at

A. of incision into mucous membrane.

B. of elevation of periosteum.

C. of opening by small burr,  $\frac{5}{16}$ -inch.

D. of enlargement of opening by large burr,  $\frac{5}{8}$ -inch.

A bony opening of this size is large enough to inspect the antrum cavity thoroughly if a head mirror is used, yet if properly placed it is small enough to escape injury to the infraorbital nerve, to the roots and to the nerve supply of the teeth.

The periosteum is elevated over the anterior wall (Figs. 3 and 4), and a circular opening made into the antrum, about five-eighths inch in diameter (Fig. 3). This is done either by Alexander mastoid chisels (Fig. 5) which allow the obtaining

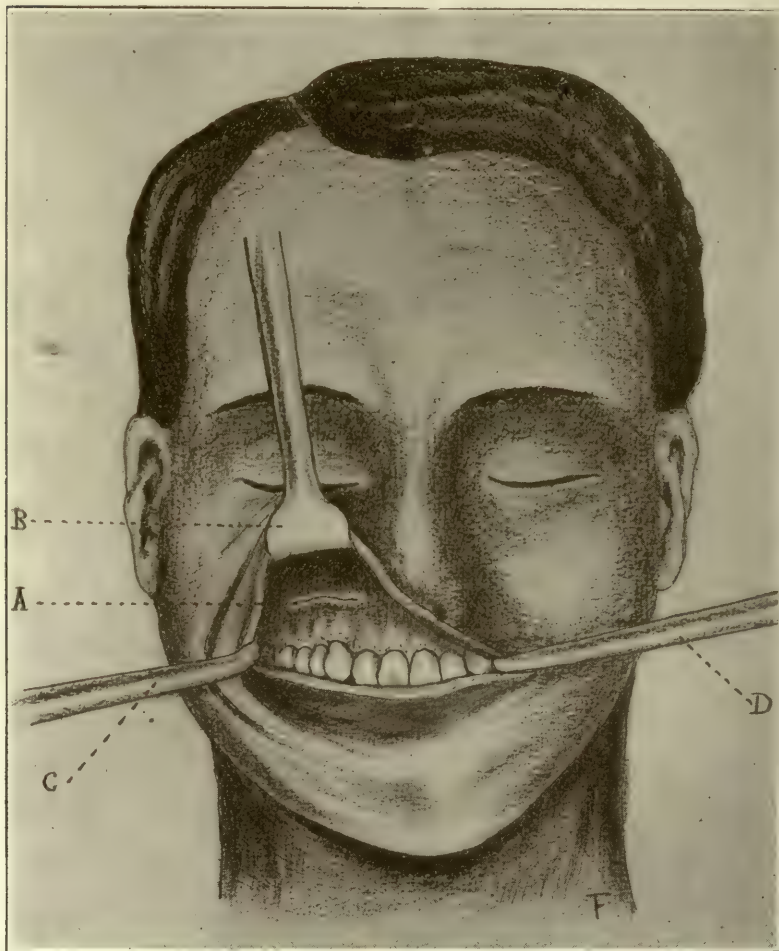


Fig. 4.

- A. Incision into the mucous membrane down to periosteum.
- B. Retractor.
- C. Suction tip.
- D. Anesthetic tip from ether blowing machine.

of a specimen of bone, or by drills. The Hudson hand drill (Fig. 6) provides a quick way for entering the antrum, the small burr being used first, followed by the larger burr. The

location of the opening well above the roots of the teeth is shown in Figs. 3 and 5. It should be placed far enough laterally to escape the anterior dental branch of the infraorbital. A round mastoid spoon curette No. 3 is used to make the initial perforation through the nasal wall. First the posterior

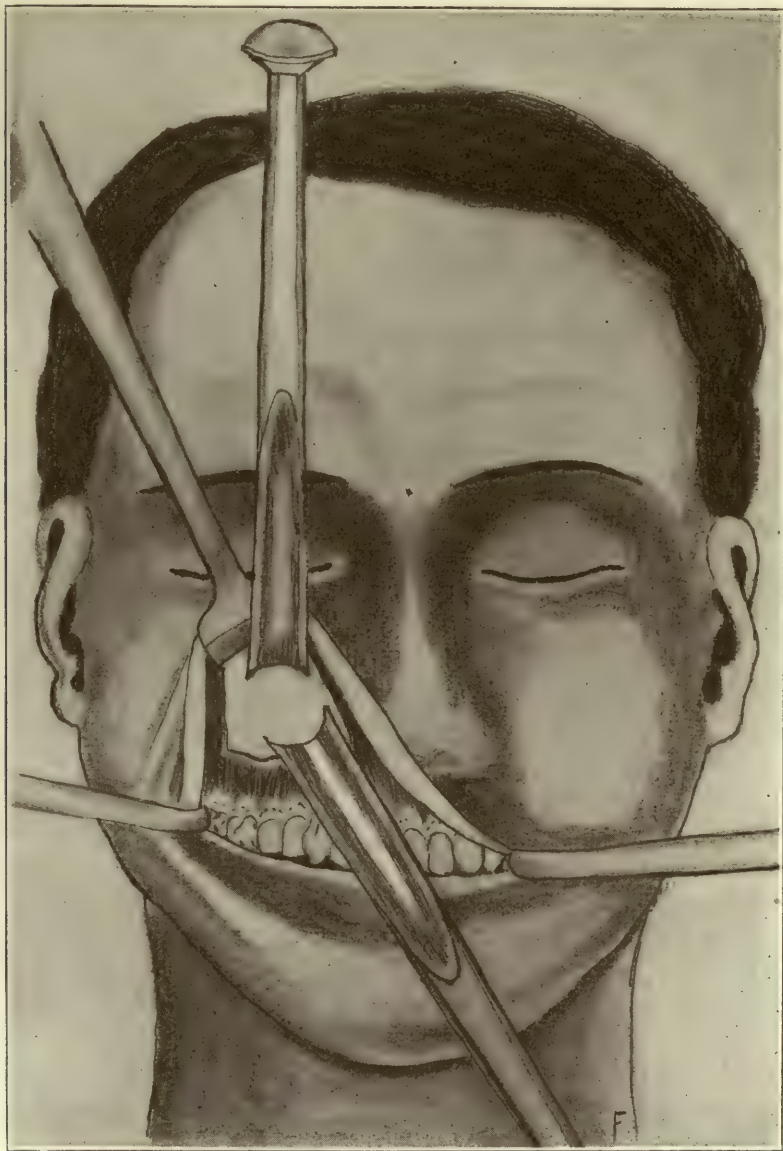


Fig. 5. Method of opening by Alexander chisels. This method is used in order to obtain a specimen of bone for microscope.

limit of the antrum is located by the curette. If the field is obscured by persistent bleeding, this can be done by the sense of touch. The instrument is withdrawn slightly forward, and the nasal wall broken through at its lowest point. A large size Ostrom forcep is now introduced and the blade engages the nasal wall through this opening. Still hugging the floor, the nasal wall is rapidly bitten away under the inferior turbinate along the floor. The inferior turbinate thus escapes injury; indeed, it is impossible to injure it if this technic is

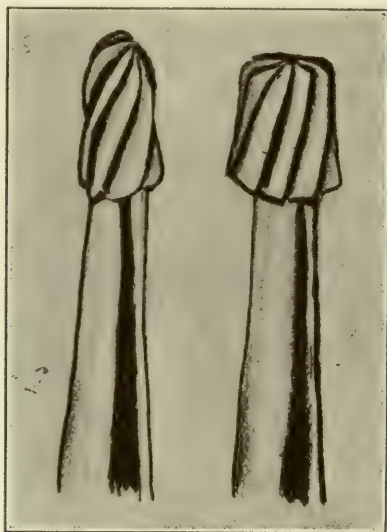


Fig. 6. Small (eccentric point, 5/16-inch) and large drill point, 5/8-inch, (actual size). Used with Hudson hand drill to make initial opening when no specimen is desired.

followed. I use a strong light and a head mirror, and generally the operation is done by direct inspection. However, if it is impossible to keep the field free of hemorrhage, the work can all be done by the sense of location and knowledge of the anatomy, and the time shortened greatly. There is no attempt made to curette away the mucous membrane, except in a polypoid case, when the curetting is done very gently. The object is always to preserve the mucous membrane. No astringents are used on the mucous membrane, such as strong zinc solutions, either at the operation or subsequently. They are found to be unnecessary.

The mucous membrane thus preserved and treated by the

constant washing to be shortly described, will return so nearly to normal, that it makes a very much more desirable lining to the antrum than the scar tissue resulting if the membrane is removed. This conservation of the antrum mucous membrane adds very greatly to the area of mucous membrane of the nose and its accessory cavities, and to its function of moistening and warming the inspired air. The Ostrom forceps should be of a larger size, and strongly built. (Fig. 7). They are admirably suited to this operation, as they cannot leave the inferior meatus nor injure the inferior turbinate, the inferior

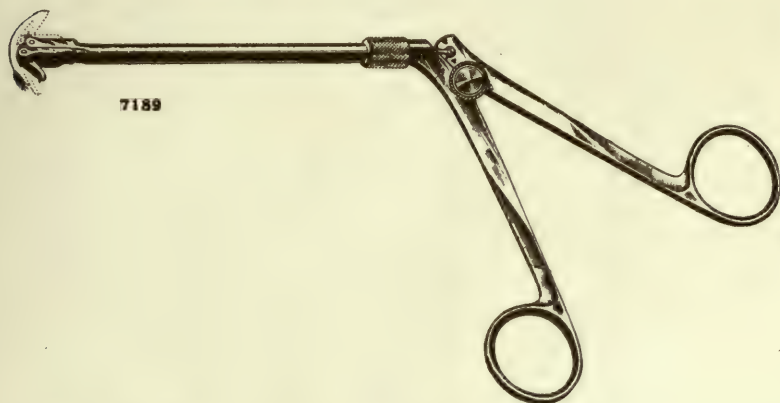


Fig. 7. The Ostrom forward cutting forceps used in cutting out the nasal wall.

The primary opening is made by a bone curette at the posterior inferior portion of the nasoantral wall. The Ostrom forcep then bites out all the bony wall of the inferior meatus, especially enlarging the anterior end of the opening.

turbinate preventing the grasp of anything above its insertion. The operator thus feels every assurance that his opening is in the inferior meatus even if blood obscures the field. The curette is now used as a probe to feel the size of the nasal opening obtained, and if necessary to enlarge still further the anterior extremity of the nasal opening. One of the curettes should be somewhat heavier and stronger than the ordinary mastoid curette, as sometimes the nasal wall is of ivory hardness, and if the curette head should break off while making the initial opening into the nose it might be very hard to recover it. If the opening into the nose is now felt to be amply sufficient, a rubber tube perforated in its upper portion is introduced into the antrum, pushed in as far as possible, and the lower end allowed to project about three-fourths of an

inch into the mouth. The incision is closed by one catgut suture, central to the tube, and the ends of this suture are tied several times around the tube and return to secure it in its position. (Fig. 8). The tube is not perforated by the suture as it is necessary later to wash through it. The tube is now cut off short enough to be concealed by the lip. Care

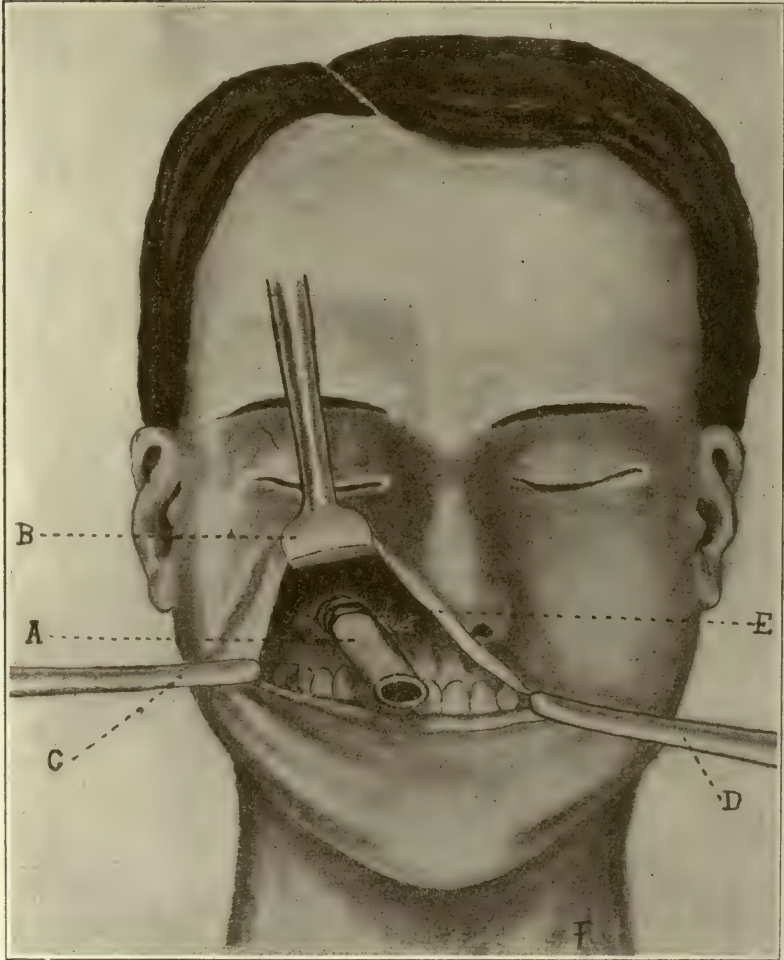


Fig. 8.

- A. Rubber tube. Used for irrigating. Removed with suture in 24 hours, after which irrigation is carried out as in Fig. 9.
- B. Retractor.
- C. Suction tube.
- D. Ether tube.
- E. Suture though mucous membrane, tied and passed several times around tube.

should be taken, however, that it is long enough to rest against the upper wall of the antrum, or it may disappear into the antrum and be hard to recover the next morning. This completes the operation, the patient is returned to bed, and the nurse instructed to keep him lying on his face until he is well out from his anesthesia. Actual operating time is usually very short. The suction must be working well, and should be applied to the pharynx and also within the antrum cavity itself. Extra suction tubes should be on hand in case one tube becomes obstructed either from bone dust, chips or blood clots. A bowl of water to dip the suction end into aids materially in keeping the suction clear.

WASHING. The washing out after operation is extremely simple. An ordinary soft rubber bulb ear syringe and a solution of one-fourth of one percent bborat of soda solution is used. (Fig. 9). The syringe should be the red rubber variety, in which the stem gradually increases in size, rather than the gray rubber, in which the stem is uniform up to the bulb. The solution need not always be heated; it is better tepid, but can be used at room temperature. During the first twenty-four hours irrigations are commenced about six hours after operation, are carried on through the tube, and are used about every three hours. After twenty-four hours, the tube is removed and irrigations are now carried on directly by the soft rubber bulb ear syringe through the oral opening, every half hour during the day, and about three or four times during the night. The irrigations are very easily and painlessly performed. If a special nurse is not available, a relative or friend of the patient, or he himself can be easily instructed in the procedure. The syringe should be in the patient's left hand for washing the left antrum, and in the right hand for washing the right antrum, as this gives the point the proper direction and it can be inserted without pain. The nose is blown after each washing, as sometimes the heavy secretion will otherwise remain in the nasal cavities. In practice it is found that the patients almost invariably learn to do their own washing on the second day, and they are then allowed to leave the hospital on the third or fourth. They then return to their home and give their absolute attention to constant washing for about two weeks returning to the office daily for observation. At the end of two weeks, it becomes difficult to get the point of the syringe into the oral opening and

the return flow by this time is generally clear. The washing is continued through the gum as long as possible, but if the opening is patent and the return is clear at the end of two weeks, the irrigations are lessened in frequency. A nasal wash is given to be used with a glass nasal douche after the

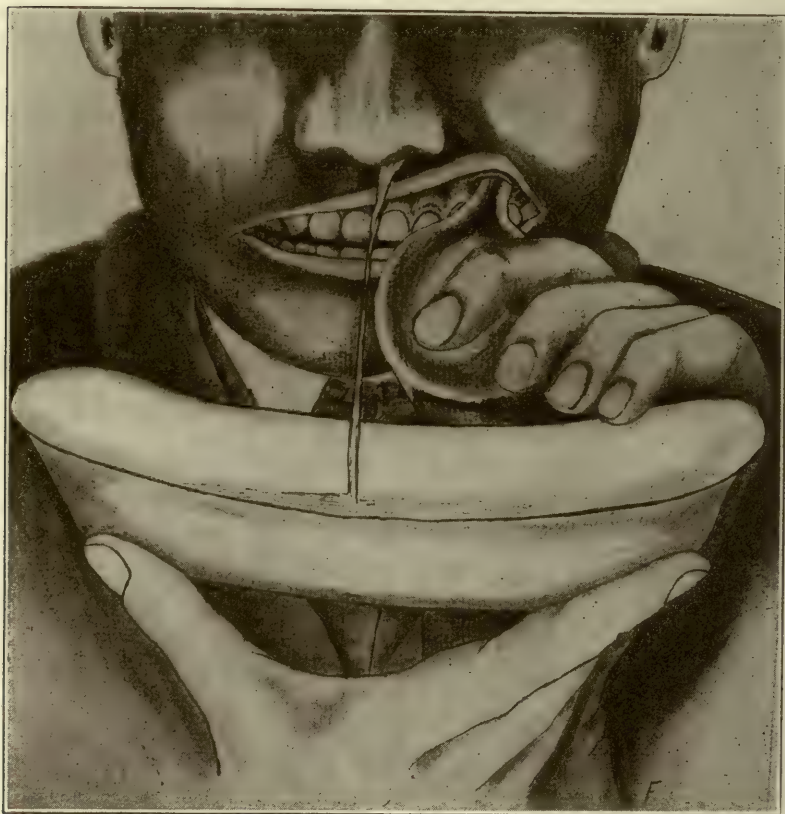


Fig. 9. Through and through washing carried out by the patient or nurse every half hour during the day, and two or three times during the night, until the opening closes itself, which is usually in two weeks. The opening has never remained longer than three weeks. Irrigating fluid is sod. bibor. (borax) five per cent.

oral opening has closed. This is used about three times a day. After the opening in the gum closes, the usual nasal washing with a curved canula can be carried out by the nasal route, as is done in the intranasal operation. This is seldom necessary as a routine for any length of time, but is used to determine if the antrum is remaining free from pus. Often some little time after the antrum is apparently clear, an acute in-

fection takes place, which, however, subsides in a few days by daily washings of the antrum through the nasal opening. It is comparatively easy for most patients themselves to insert a Eustachian catheter through the nose into the antrum, and then with the same rubber syringe they used for oral washing irrigate through the catheter. The tip of the rubber syringe fits perfectly into the end of the catheter without any other attachment.

**SEVERITY OF OPERATION.** The view in which oral operations are held by the rhinologists generally is well expressed by Dr. H. W. Loeb<sup>3</sup> in his "Operative Surgery of the Nose, Throat and Ear." He states in regard to oral operations including Caldwell's, Luc's, Denker's, Beck's and Partsches operations:

"Very good results follow the operations, as good drainage is established through the nose and reinfection is uncommon." He adds, however, "various accidents and other unpleasant results may follow these operations. Among them may be mentioned aspiration pneumonia, anesthesia of the cheek or teeth, emphysema of the cheek, neuralgia of the fifth nerve and osteomyelitis of the maxilla."

Of these accidents and unpleasant results, out of a series of over one hundred cases, I have had only the anesthesia of the lip occur, and this has always in time cleared up.

There has been occasionally apprehension expressed that the nerve supply to the teeth may be injured. I have seen no evidence of this, though I have studied carefully X-rays of the teeth as long as two years after the operation. These showed absolutely no change in the apices or in the cancellous structure of the surrounding bone. On subsequent washings of the antrum months after the operation, the patient generally says he feels it in his teeth, showing the nerve supply is intact.

**APPEARANCE OF THE NOSE AFTER OPERATION.** After healing, the examination of the nasal cavities usually shows a normal appearance, and there is no sign of any surgical interference. Sometimes the opening is visible beneath the inferior turbinate; as a rule, however, it is impossible to see it, though it can be readily found with the curved canula used for washing after the oral opening is closed. There is an absence of the scabs of mucopurulent secretion seen in the middle fossa before the operation. In cases which have shown atrophy be-

fore operation, the turbinates show a marked tendency to re-filling, and the nasal cavity returns much nearer to normal than would be thought possible. When suffering from a cold, the infected secretion from the antra can often be seen coming from under the inferior turbinates, but the patient's report is that colds are less frequent, are never severe and always clear up after a few nasal washings. I have seldom seen polyps develop in the nose after this operation and washing, even in those cases which had periodically come to me for polyp removal for years previous to the washing out of their antrums. The red streaks on the pharynx, just posterior to the posterior tonsillar pillars, clear up except during acute colds, and the pharynx returns to normal. The heavy scabs and the thick skin like coating over the pharynx and in the nasal pharynx disappear, even in patients where they have been present for years or decades. After having conscientiously washed and sprayed and swabbed postnasal catarrhs for years, never realizing that most of them come from diseased antra, there is a large degree of satisfaction in having finally got the better of them, and in being able to at least discard the postnasal syringe and the silver nitrat applicators. After operation, the antrum can easily be inspected for several days with a medium sized Killian nasal speculum inserted in the gum opening. The nose has no reactive swelling even immediately after operation, and good nasal breathing is maintained the night following operation. The cheek is usually only slightly swollen, or there may be no swelling at all. This is particularly the case since I have adopted the plan of removing the tubes after the first twenty-four hours. The oral opening has never failed to heal within two or three weeks, and one month later hardly any evidence of it remains. I still do the intranasal operation in some of my antrum cases, but of the two procedures I regard the technic described as being the more conservative operation. There is less general reaction, the interior of the nose is better preserved, the mucosa of the antrum has a better chance to return to normal.

## REFERENCES.

1. Caldwell, Geo. W. New York Medical Journal, 1893, Page 526.
2. Luc, Dr. Annals of Otolology, 1903.
3. Loeb, Hanau W. Operative Surgery of the Nose, Throat and Ear, Vol II, Page 114.

## DISCUSSION.

DR. L. W. DEAN, Iowa City, Iowa: The only cases of maxillary sinus disease where I have attempted irrigation through the mouth, were those cases where there was extensive necrosis of the alveolar process, and where, in spite of everything that I could do at the time of the first operation, I did not succeed in closing permanently the opening between the mouth and the maxillary sinus. So far as I could tell in these cases, there was no particular advantage secured from irrigation through the opening into the mouth.

Doctor Lemere did not have time to go into the indications for his operation. I anticipate that if he had done so, he would have stated that this operation would not be indicated in childhood before the eruption of the permanent teeth.

DR. SAM E. ROBERTS, Kansas City, Missouri: Doctor Lemere was kind enough to demonstrate his technic to me several months ago. Since that time I have had a personal experience with only eight cases, and it is too early to report definite results.

The two principles on which he bases his technic, first, that of conservation of intranasal and intrasinus mucosa, and second, through and through drainage, should appeal to every conservative operator. I consider the chief disadvantage of the technic is the inability of the operator to thoroughly inspect the sinus during the operation, and therefore his inability to verify the clinical diagnosis of latent antrum infection. The two cases I have had to reoperate to date, by the Denker method, have both shown polypoid degeneration, which was entirely overlooked at the first operation. I have also been unable to maintain the inferior meatal opening longer than four weeks, even though I used the large Ostrum forceps at operation, and carried out the postoperative treatment as accurately as possible.

I do not want it understood that these criticisms, or my failures, are in any way a condemnation of the procedure as a whole; but I do feel that certain modifications of technic are still needed, and a very careful selection of cases to conform to the author's indications for his operation. I believe Lemere's technic is a step in the right direction in the treatment of mild latent antrum infection. He should be encouraged to present further reports to this Academy in the future.

DR. J. L. MYERS, Kansas City, Missouri: Doctor Lemere has spoken about preserving the nerve that goes down to the incisor teeth. We learned in studying the anatomy of the antrum, that the incisor and canine teeth receive their direct blood and nerve supply through canals in the bony wall which forms the anterior portion of the antrum. Doctor Lemere's operation may miss these nerves if he goes far enough externally, but I fear it may have the same effect as other radical operations.

In doing a radical operation, e.g., Caldwell-Luc or Denker, in which a large portion of bone is removed in the canine fossa, the direct nerve and blood supply to these teeth is destroyed. We have X-ray pictures of teeth of patients who have had a radical operation on the antrum, and in a number of cases have found apical abscesses.

I think it is up to the nose and throat men to study this problem and determine whether we are damaging the teeth by performing these

radical operations. Our work should leave the patient in a more normal condition than if the operation had not been performed. When we perform a radical operation on an antrum, we are severing and removing a large portion of the direct blood and nerve supply of these teeth. If this causes a dead tooth, and if a dead tooth is a thing that should come out, we should be more conservative in our work.

DR. EMIL MAYER, New York City: I would like to ask the essayist to say in closing whether he has any trouble with patients who wear this tube getting food into the tube. Also, whether the presence of the tube finally causes a suppurative process that was not there before.

DR. H. B. LEMERE, Omaha, Neb. (closing): Answering Dr. Dean, I think the main value in constant irrigation is in those cases which are suffering from what is known by the laity and the profession as nervous prostration. Their extreme nervous excitability precludes almost any intranasal treatment, and the painlessness of the through and through irrigation makes it possible to tide these patients over the operative period without any shock or increase of general nervous excitability.

I agree with Dr. Dean as to the inadvisability of interfering with the anterior bony wall of the antrum in early childhood. After the permanent teeth are erupted, and the X-ray shows sufficient room in the anterior wall for an opening without coming near the apices of the teeth, the operator may decide that it is advantageous to use this method.

I have taken up the size of the opening more in detail in my paper than I had time to emphasize in my presentation. I think the exact size and placing of the opening in the anterior wall is one of the divergent points in my procedure from that of Caldwell or Denker. The removal of a large amount of bone in the anterior wall makes the objection of Dr. Myers as to the injury to the nerve supply of the teeth almost certain. With my small opening placed outward and upward, however, the teeth are not interfered with. I have examined X-rays of the teeth on my operated patients a year after the operation and have found the apices and the cancellous bone in perfect condition.

It is impossible to answer Dr. Roberts' inquiry in regard to diagnosis satisfactorily in a few words. The local symptoms pointing to infection of the maxillary antrum may be one or more of the following: excessive secretion from the nose or nasopharynx; dry scabs on the anterior ends of the middle turbinates, or in the nasopharynx; granular condition of the anterior end of the middle turbinate; nasal polyps; ozena; swelling of lymphatic pillars on the back of pharynx; findings in the Waters' position of X-ray pictures. The general history may give one or more of the following symptoms: occipital and frontal headaches and neuralgia, sallow color, nervousness, lack of energy and eye and ear symptoms.

The study of bone taken from the anterior and nasal wall and mucous membrane of the antrum, and cultures from antrum washings and the blood count enable us to further interpret correctly our pre- and post-operative experience. These studies should be carried over a series of cases, in order to understand the diagnostic value of local signs, X-ray and general symptoms.

I can say in answer to Dr. Mayer's question, that the danger of food entering the antrum is nil. The lips of the gum incision lie in close

opposition, and act as a valve to prevent food entering the antrum. If food were to enter the antrum, it would be in such small fragments that it would be immediately washed out by the through and through irrigation. I have never seen such particles in the washings. The tube stays in only twenty four hours, and as it is about one and one half inches long, it is impossible for food to pass through it very easily.

## CAUSES OF FAILURE IN SURGERY OF THE NASAL ACCESSORY SINUSES.

WILLIAM MITHOEFER, M.D., F.A.C.S.

CINCINNATI.

During the past fifteen years, intranasal operative measures for the relief of accessory sinus disease have been the methods of choice by the majority of rhinologists. We have been able through our mechanical skill and our knowledge of the anatomy, to deal radically with the affected cavities but, unfortunately, even after a most thorough intranasal removal of all diseased tissue, we have often asked ourselves the following questions: Has the end justified the means? It not the patient in the same or worse condition than before the operation? Why have we failed in our endeavor? If we attempt to analyze carefully the various factors that play a role in the causation of our failure, we find that in many instances a probable explanation may be given.

The most important causes of failure are:

1. Lack of knowledge regarding the anatomic variations of the accessory cavities, especially of the ethmoid.
2. Negligence in not making a general physical examination of the patient before operation.
3. Lack of persistence in trying to relieve the patient with conservative treatment of the nose.
4. Insufficient consideration and examination of all sinuses and the nasal mucosa before operating.
5. Lack of knowledge regarding the character of the infection.
6. General anesthesia.
7. Insufficient after treatment.

ANATOMIC VARIATIONS. This phase of the subject deals principally with the lateral displacements of the ethmoid labyrinth, for the detection of which a careful study of the skiagram is necessary. It behooves us to give a guarded prognosis as to the ultimate success of an intranasal operation when the skiagram shows the presence of an orbital extension of the ethmoid labyrinth. It is in these patients with laterally displaced ethmoid cells that failure most often

occurs. Chronic disease of the orbital cells, whether suppurative or hyperplastic, gives rise to symptoms similar to those of frontal sinus involvement, and it has been our experience on several occasions in doing a radical frontal sinus operation to find the frontal sinus absolutely healthy, but the orbital ethmoid cells very much involved. We have been impressed in these cases by the futility of endonasal surgery, and in some cases firmly believe that the external ethmoid operation should be the method of choice, and that endonasal measures should not be attempted. Primary radical ethmoid surgery is indicated in only well selected, carefully studied cases, and in all patients showing evidence of meningeal involvement. In the majority of cases, on the other hand, it is advisable to begin with an endonasal operation, for it may happen that drainage of the orbital cells or the widening of the nasofrontal duct will be sufficient to relieve the patient of an obstinate headache.

Anatomic variations of the frontal sinuses are of frequent occurrence. When the skiagram shows the frontal sinus opaque and divided into numerous compartments, we may expect little or no benefit from an intranasal operation. The same is true when the interfrontal septum of the healthy side is displaced to such an extent, that it causes a narrowing of the nasofrontal duct leading to the affected frontal sinus of the opposite side. A large frontal sinus with a well marked temporal recess is another anatomic variation that may be the cause of our failure. A mucocoele or pyocoele of the anterior ethmoid cells, extending upward into the cavity of the frontal, is a condition met with occasionally in doing a radical operation. In one case which was operated upon during the past year, the pyocoele was as large as a pigeon's egg, so that there was complete closure of the frontal ostium. The only part of the frontal sinus not occupied by the pyocoele was a small temporal portion which was found full of granulations and inspissated pus. It is obvious that intranasal surgery is of no avail in cases with this kind of anatomic variation.

The width and position of the nasofrontal duct is another interesting anatomic study. The duct is narrowed by the presence of enlarged subfrontal infundibular cells with or without intrafrontal dilatations. When the subfrontal cells are

enlarged, they may also displace the nasofrontal duct in various directions. It may be displaced anteriorly, posteriorly, to the midline, or towards the orbit in a markedly lateral direction. A high bony septal deviation may also be the means of closing the duct.

In considering the anatomic factors pertaining to the maxillary sinus, we must mention the various recesses such as the malar, alveolar, palatine and prelacrimar, that are often found well developed, and cannot be reached except by radical means. We must also remember that bony septa occasionally divide the cavity into several compartments and, furthermore, that the floor of the maxillary sinus, especially in the adult male, lies at a much lower level than the floor of the nose, so that no matter how radical the operation, infective processes may continue to exist in this region.

So much for the anatomic phase of the subject. Summing up what has been said, it becomes manifest that the anatomic variations play a most important part in preventing us from getting good results in our surgery of the nasal accessory sinuses. If we remember these various anatomic reasons for failure, we shall be able to treat more intelligently some of the intractable cases that come under our observation.

It may not be amiss in this connection to say a few words concerning the skiagram. It is our opinion that a skiagram is dispensable for the making of a diagnosis of accessory sinus disease, but that it is indispensable if an operation is contemplated on either the ethmoid or the frontal sinus. Every well trained rhinologist should be able to make a diagnosis of accessory sinus disease by means of the various diagnostic methods at his command, and he should rely on the skiagram only as a means of informing himself regarding the anatomic variations of the cells. We consider the X-ray picture as an adjunct of secondary importance. The reason for this is quite obvious. We have seen skiagrams with marked opacity of the various sinuses, in which there was no clinical evidence of disease. We have seen others where clinically there was present every evidence of involvement, but the roentgen picture was negative, so that he who jumps at definite conclusions from the appearance of the skiagram alone is making a grave error.

The second cause of failure to be considered is our NEGLIGENCE IN NOT MAKING A CAREFUL PHYSICAL EXAMINATION OF THE PATIENT PRIOR TO OPERATION. Advanced age, for instance, is certainly a plea for conservatism, and an operation should not be attempted unless the symptoms are of such severity as to make the interference absolutely imperative. In operating on older patients, great care and gentleness must be exercised on account of the brittleness of the bones and the danger of fracturing the cribriform plate.

The most important factors to be considered in the general examination are the condition of the blood, urine, sputum, eyes, teeth, tonsils, heart, lungs, intestinal tract, ductless glands, and the muscles of the neck. A careful analytic study of each patient will often reveal some disturbance of the general state of health, and consequently make us more conservative. Take, for example, a patient in whom there is present a mild hyperplastic ethmoiditis with severe headache. Examination of the eyes shows the presence of a muscular asthenopia which after proper correction entirely relieves the headache. It is true the patient still has a chronic ethmoiditis, but it is of little consequence since the headache, which was the chief complaint, is relieved and the symptoms of the ethmoiditis are mild in character.

There is another type of patient in whom the nasal mucosa is constantly in a state of chronic infiltration, and who seeks medical aid for the relief of an incessant headache. A careful study of this patient shows that there are present symptoms of hypothyroidism. The insufficiency of the thyroid is usually of the benign type without any external evidence of myxedema. The cellular protoplasm of these patients is constantly overloaded with mucin and fat, and the headache is probably due to an infiltration of nerve cells and of the meninges. We have observed cases of this type in which headaches disappeared after the use of small doses of thyroid extract over a long period. Some of these patients state that, while taking the thyroid, the insomnia from which they had long suffered disappeared, and that the constipation was overcome. The intestinal stasis, which is a characteristic symptom of hypothyroidism, is probably due to a muscular infiltration of the intestinal wall. The study of the endocrines is still in its infancy and gives much food for thought.

It is a characteristic fact that the removal of the tonsils will often relieve a headache of long standing, and occasionally do away with an intractable case of vasomotor rhinitis. The extraction of a tooth may clear up an old antrum infection and an impacted third molar may be easily overlooked.

Very few rhinologists, in making a routine examination, ever consider the condition of the muscles of the neck. There is often present a myalgia (probably the result of some focus of infection) which causes severe headache radiating from the occiput to the forehead. The muscles of the neck are hypertonic; the sternoclavicular joints and the cervical vertebrae are painful on pressure. A marked case of myalgia of the neck present in a patient with accessory sinus disease will seldom be relieved after operation. Other means such as mild massage, injections of calcium chlorid, sodium chlorid and novocain solutions into the muscles may overcome the hypertonicity and relieve the headache. There is much to be said regarding the examination of the muscles of the neck, but time will not permit me to touch upon the subject except in a cursory way. It behooves us, however, to give these muscles the attention they deserve.

Chronic bronchitis with bronchiectasis is often present in suppurative accessory sinus disease, and should be recognized before operation. In these patients, the cough does not always disappear unless other therapeutic means are used, even though the accessory sinus suppuration has been eradicated.

It is needless to say that a Wassermann test should be made on every patient upon whom a sinus operation is contemplated. We have made a Wassermann on all cases, and have been impressed with the fact that syphilitic involvement of the accessory sinuses is present many times when least suspected.

Let us now consider the third cause of failure,—LACK OF PERSISTENCE IN TRYING TO RELIEVE THE PATIENT WITH CONSERVATIVE TREATMENT OF THE NOSE. There are some patients who complain of many of the symptoms of nasal sinus disease, in whom we cannot clinically demonstrate the presence of a sinus involvement. These patients usually suffer from a form of nasal neurosis and are rarely benefited by surgery. It is true that a great many of them have a latent ethmoiditis,

usually of the hyperplastic type, but in the majority of instances, even after a most thorough and painstaking operation, the patient continues to sneeze, has the same hypersecretion and headache as before. To prevent failure in these cases, the nasal neurosis must be the primary consideration and be properly treated, even though there may be clinical evidence of a mild ethmoiditis.

Conservatism should be the first consideration in all mild types of inflammation of the accessory sinuses. Simple means such as the correction of a nasal obstruction, the infraction of the middle turbinate, the application of various astringents to the region of the sphenopalatine branches and the anterior ethmoid nerves will often relieve patients of their distressing headache and render an operation unnecessary. Good results after radical procedures in these cases of mild ethmoiditis are less frequent than after conservative treatment.

We now come to a very important part of this subject and one that is very often the cause of failure, namely, INSUFFICIENT CONSIDERATION AND EXAMINATION OF ALL THE SINUSES AND THE NASAL MUCOSA BEFORE OPERATING. The method of procedure in the operation will have to depend entirely on the clinical findings and the results obtained from the use of the various diagnostic measures at our command. Take, for instance, a maxillary sinus suppuration. The first requisite in these cases, after the teeth as a causative factor have been excluded, is to determine whether the antrum is primarily involved, or whether it is only acting as a reservoir for pus from above. It very often happens that the inferior hiatus cells are diseased, and are the sole cause of the antrum suppuration. Unless these cells are dealt with at the time of operation on the antrum, our endeavor will be met with failure. The antrum continues to discharge pus, and the patient may be in a worse condition than before the operation. Especially is this true if a part of the inferior turbinate has been sacrificed. In these cases, there may be added to the old trouble another distressing complication in the form of a postoperative rhinitis sicca with crust formation. It is, therefore, far better in many of these cases to approach the antrum from above by removing the hiatus cells and enlarging the natural opening of the antrum. This is a conservative operative procedure and gives better results than an opening made in the inferior meatal wall.

When pathologic changes have taken place in the antrum, a more radical procedure must be adopted but, in most cases, the hiatus cells must be thoroughly removed.

Marked involvement of the ethmoid labyrinth may be present without affecting the frontal sinus, but it rarely happens that the ethmoid labyrinth escapes infection if there is present a chronic frontal sinus disease. If sufficient attention is not given the sphenoid cavity in the course of the examination, pathologic changes present in this region may easily be overlooked. I doubt very much if suppuration of the sphenoid cavity ever exists without some involvement of the adjacent posterior ethmoid cells. Simple hyperplasia of the anterior sphenoid wall, with consequent closure of the ostium, is often sufficient to cause severe symptoms. The lining membrane of the sphenoid cavity in many of these cases is not hyperplastic. The various eye and nerve manifestations that occur are probably accounted for by the circulatory changes that take place from closure of the ostium. In patients with recurrent polypi, it becomes necessary, if a good result is to be obtained, to examine carefully the condition of the antrum. If the skiagram is opaque, far better results are obtained if we begin the operation by dealing radically with the antrum and removing all polypi, which are usually found filling this cavity. The ethmoid labyrinth is dealt with at the same time. If, after such a radical procedure, polypi still continue to form and make their appearance in the region of the nasofrontal duct, we may be reasonably certain that the orbital ethmoid cells and frontal sinus are also involved. If the symptoms demand an interference, an external ethmofrontal operation will give the best results. We saw recently a patient who had sought medical aid for nine years for relief from a severe nasal hydrorrhea with chronic eczema of the lip and recurrent polypi. He was under our observation for over a year, during which time radical operations were done upon all the sinuses. He was not entirely relieved until after a bilateral external ethmofrontal operation. Failures in these cases will be less frequent if we begin the operative work in the antrum and radically remove every vestige of polypoid tissue.

In all atrophic states of the nasal mucosa, we must proceed with caution, being as conservative as possible. Operation in the presence of atrophy is often followed by crust

formation which may continue indefinitely. If radical surgery is necessary in these cases, care must be taken not to curette the atrophic membrane of the accessory sinus.

It is necessary in ethmoid surgery to operate with more gentleness, and to abstain as much as possible from indiscriminate curetting of the mucous membrane with sharp instruments. If the middle turbinate is not too large, it should be displaced to the middle line as a primary step of the operation. There are various good reasons for the preservation of the middle turbinate in ethmoid surgery. In the first place, we are retaining a functioning mucous membrane, rich in glands. We are preventing the formation in the middle meatus of a large open and raw surface which is often the cause of great discomfort in cold weather, and predisposes the individual to recurrent attacks of infection. We are, furthermore, preventing the possibility of a postoperative rhinitis sicca, and lastly and most important of all, we are making the operation less dangerous by working to the lateral side of the median plate, away from the olfactory sheaths which are in direct communication with the arachnoid space. Postoperative meningitis should be of rare occurrence if the middle turbinate is preserved.

We will next consider the BACTERIOLOGIC side of the question. Failure to make a bacteriologic examination of the nasal discharge before operation will often lead us into difficulty and may endanger the life of the patient. We should certainly not operate in the presence of a streptococcus hemolyticus infection unless urgent symptoms are present, and then only in a radical way, in order to insure perfect drainage and ventilation. Furthermore, we should consider it poor surgery to operate when there is present a large quantity of pus, and would rather treat the case, for the time being at least, in a conservative way. When atrophy with or without ozena is present, we usually find the bacillus mucosus. When these organisms are found, we may depend on the case being an intractable one. The staphylococcus albus usually predominates in all of the chronic suppurative cases. During an acute exacerbation, other more virulent organisms prevail and their presence at this time undoubtedly adds to the danger of the operation.

We have mentioned before that we consider the ADMIN-

ISTRATION OF A GENERAL ANESTHETIC to be one of the causative factors in our failures. Our experience during the past two years with the use of local anesthesia in all radical accessory sinus surgery, including the radical frontal operation, has convinced us that better and more thorough eradication of all diseased cells can be done with this method. There is little bleeding, the operation is technically easier to perform, the patient has less shock, and the operator is never hurried and can leisurely examine every recess that may if overlooked cause a postoperative retention.

There are other factors too that prevent us from getting good results in radical frontal sinus surgery. We cannot hope for a good result if we use the same method of procedure in every case. We must vary our technic with the anatomic situation of the cells.

One of the most important parts of the operation is the removal of the orbital prolongations of the ethmoid labyrinth, so that any operation on the frontal sinus that fails to uncover these cells is not sufficiently radical to prevent postoperative retention. Under local anesthesia, it becomes a simple procedure to approach the sinus from the orbital wall as described by Ritter. By opening the sinus in this location, there is also less danger of meningitis. Postoperative meningitis after frontal sinus operation is often caused by a thrombophlebitis of the diploic veins in the anterior wall of the sinus. If we are able to simplify the radical frontal sinus operation by the use of local anesthesia, by treating each case according to the anatomic findings, and by not entering the sinus, unless necessary, through the anterior wall, we shall obtain better results in our work.

A carefully executed operation often fails to give a good result on account of INSUFFICIENT AFTER TREATMENT. This applies chiefly to the ethmoid region. Patients must be treated at regular intervals after the first week, and edematous mucous membrane cauterized until the entire cavity has healed with a smooth scar. Good results seldom take place if the after treatment is neglected.

In conclusion let me impress upon you again that the proper study of each individual patient before operation is absolutely imperative. If all the known causes for failure have been duly weighed in the balance, our results will be

more satisfactory. There has been a tendency during the past few years among medical men to deprecate the value of accessory sinus surgery. This state of affairs is undoubtedly the result of indiscriminate operating without due regard of the many conditions, both local and general, that should always be investigated when an operation is contemplated. If a careful analytic study is made of each individual patient, better results will be obtained and there will be less danger of surgery of the nasal accessory sinuses falling into disrepute.

## BIBLIOGRAPHY.

1. Grünwald. Die klinische Bedeutung der Derivate des Hiatus semilunaris. Arch. Laryn. 1910, XXIII, 183.
2. Hajek, M. Path. und Therap. der entzündlichen Erkrankungen der Nebenhöhlen der Nase. 1915.
3. Rhese. Die chronischen Entzündungen der Siebbeinzellen und der Keilbeinhöhle, etc. Arch. f. Laryn. etc., 1911, XXIV, 383.
4. Sluder, G. Concerning some Headaches and Eye Disorders of Nasal Origin. 1918.
5. Skillern, R. H. The Ethmoid Problem. Laryngoscope, 1920, XXX, 687.
6. Winkler, E. Ueber Therapie der Stirnhöhlenerkrankungen. Arch. f. Laryn. etc., 1914, XXIX, 113.

## DISCUSSION.

DR. ROSS H. SKILLERN, Philadelphia: I think Doctor Mithoefer's paper is such an important contribution to our knowledge of accessory sinus disease, that I shall take up the various headings seriatim.

First: "Lack of knowledge regarding the anatomic variation of the accessory cavities." Should anything go wrong after an operation, little excuse can be offered by the operator along these lines, that is, that he did not appreciate the possibilities as far as the anatomic construction of the sinuses were concerned. There is no excuse whatever for not having an X-ray picture made which will give one this information fairly definitely as far as the size, shape and extent of the sinus is concerned. That particularly obtains in the frontal and maxillary sinuses, the sphenoid cells and ethmoid not so well. In the ethmoid, however, the cells should be studied with the stereoscope. Of course there are times when we must go into sinuses without having opportunity to have an X-ray made, for instance, in cases of sinusitis with acute complications, where one must operate at once to save the patient's life.

Second: "Negligence in not making a general physical examination of the patient before operation." I believe we have all been more or less negligent in this regard. A patient comes to us and we make a positive diagnosis of chronic maxillary sinusitis on one side. Perhaps we may look at the frontal on that side, but having made this examination we are content to rest on a positive diagnosis. In the meanwhile we operate without results, finding something overlooked, which is naturally our own fault. It is wise always to make a more or less thorough study of the other sinuses.

Third: "Improper consideration of other factors that may enter into the condition." That is not debatable. Certainly all of us before we operate will get a general idea of the condition of the patient's kidneys, blood and lungs.

Fourth: "Insufficient consideration and examination of all sinuses and the nasal mucosa before operating." There is no excuse for confusing a maxillary sinusitis with any other condition, because all one has to do is to take his needle and make a puncture, wash it out, and the pus or other pathologic secretions either appear in the returning fluid or not. As to the frontal sinus, I would like to report a case that came to me about a year ago. A gentleman came from West Virginia suffering from headaches and all the typical symptoms. In fact, he had been sent up for operation on the frontal sinus, either intranasal or extranasal, as we thought best. I made arrangements to operate on him, and in making the examination noticed a very small polyp in the frontal duct, which was removed. He had important business to attend to at that time, so arranged to come back the next week for operation. When he returned he was in fine shape, his frontal sinus congestion had cleared up, and he would not have anything done until the symptoms became more pronounced. I saw him a year afterward and he was in perfect condition. He had apparently never had a virulent infection of the mucosa, so removing the obstruction to the nasofrontal duct, thus permitting aeration, cleared up the condition.

Fifth: "Lack of persistence in trying to relieve the patient with conservative treatment of the nose." The last case will illustrate that point.

Sixth: "Lack of knowledge regarding the character of the infection. You may not agree with me, but it has been my experience that in all infections, no matter what the character, not even excluding the streptococcus viridans, it is more the general condition of the patient than the infecting microorganism in the nasal sinus that determines the severity of the attack. In certain conditions, the patient seems to be recovering when suddenly there is a violent outbreak. We lay too much stress upon the virulence of the different organisms, and not enough upon the comparative virulence of the same strain in different individuals.

In conclusion I would like to say a word regarding tests for syphilis before we operate. A Wassermann examination of every patient is theoretically sound. Practically, however, we know it is not feasible. But I think wherever there is the slightest suspicion, for the future welfare of that patient we should insist on a Wassermann. As far as operating is concerned, we should assume the role of one who is as much concerned regarding the ultimate condition of the patient as of the condition immediately following the operation, or, indeed, of the operation itself.

DR. JOHN A. CAVANAUGH, Chicago: Many of you perhaps know that I have been injecting the sphenoid cavity with a solution of malted milk and barium to show the anatomic relations.

At the present time I am trying to find a method whereby we can locate the optic nerve and the nerves surrounding the sphenoid in the same way as we figure out foreign bodies in the eye. Some of these

cases have worked out nicely, but I am not prepared to discuss that end of it. If the Chair will permit, I will be glad to pass the skiagraphs showing the injected sphenoids. Some of these are taken in the oblique, and some in the postero-anterior position; they will give an idea of the size and shape of these cavities.

The method of injecting cavities is as follows: The ostium is dilated by a small olive point bougee and a catheter introduced through the opening, the patient lying on the back, and the cavity is filled in that position. After it overflows, the excess is wiped away and a piece of cotton used as a plug to prevent the solution running out; after the picture is taken the cotton is removed. It is not necessary to remove the solution which has been injected. In my first work I used butter-milk, but found most of these cases complained of headache. Now I use malted milk and the patients seldom complain. The mixture is just a watery paste.

DR. JOS. D. HEITGER, Louisville, Ky.: The previous speakers have emphasized the anatomy of this region, and I desire to give you a method whereby you can visualize the anatomy and orient yourself in the ethmoid area. This is nothing new, but goes back to the embryologic development as given in the descriptions of Seydel, Zuckerland, Killian, Peter and Hajek. It has been known for years, but has been apparently buried for the mass of rhinologists.

The ethmoid first develops as a number of so-called *grund lamellen* and *interturbinalem gangen*. The ends of the *grund lamellen* extend into the nose as the uncinat process, bulla, middle, superior and supreme turbinates, etc. The *interturbinalem gangen* appear between the lamellen, and are recognized as the *infundibulum*, bulla cells, middle and postethmoid cells, the meati, and sphenothmoidal recess, etc. These lamellen extend through the ethmoid outwards to the lamina papyracea, upwards to the lamina cribrosa and the foveolae ethmoidales, which form the roof of the ethmoid, forward to the frontal bone, and inwards to the inner wall of the ethmoid. The general architecture of the ethmoid labyrinth is changed by extension too far forward or backward of these lamellen themselves.

These lamellen vary in number from five to seven, and in some cases there may be more, due to a variation by a longitudinal splitting of individual lamellen.

Take a longitudinal line corresponding to the plane of lamina cribrosa or foveolae ethmoidales, the roof of the ethmoid, and drop from five to seven parallel lines, bent slightly to form an angle, or consider them as representing a section of an arc of a circle. The first one from the front backwards will correspond to the uncinat process; the second, to the bulla; the third, the middle turbinate; the fourth, the superior turbinate; the fifth, the supreme turbinate, etc. This arrangement gives one a general idea of the fundamental structure of the ethmoid labyrinth. The first lamella is incomplete, the second, the bulla lamella, is often defective, the third, fourth and fifth lamellen are usually complete.

The ethmoid cells are produced by the development in the interturbinal passages or gangen of septa complete or incomplete, producing

real cells or partially complete ones. The opening of the cells determine their classification.

A thorough understanding and knowledge of this topography of the labyrinth is important for diagnosis, treatment and orientation.

Five guides are always better than one, the one so often mentioned being the middle turbinate or third lamella. The anterior ethmoid is limited externally by the lamina papyracea, above by the lamina cribrosa and foveolae ethmoidales. The nasal boundaries are more variable, the main variations occurring anteriorly against the frontal sinus; in the relations of the anterior ethmoid to the hiatus and infundibulum; in the extension of cells into the middle turbinate; and in the relations of the infundibular cells. If the bulla lamella is defective above, and does not reach the roof of the ethmoid capsule, the frontal sinus opens into the infundibulum and the bulla cells. If it does not reach the median wall it fuses with the uncinat process, and produces variations in bulla and infundibular cells. It may extend forward into the frontal sinus, producing the so-called "bulla frontalis." It may be set farther back than normal, permitting an unusual development of infundibular cells to the extent that the infundibulum is surrounded entirely by cells. A number of other types of variations of the infundibular cells occur, lack of time preventing their detailed description.

The upper portion of the third or middle turbinate lamella may be defective, failing to reach the roof, and giving us a development of orbital ethmoidal cells, the most difficult of all to reach by any method of operation.

The main defects in the lamellen of the posterior ethmoid occur when the ethmoid cells develop into the sphenoid, producing the so-called sphenoethmoidal cells. The upper cell is really ethmoidal, whereas the sphenoethmoidal cell is the lower. The lamellen may fuse posteriorly, so that the anterior wall of the sphenoid forms the posterior wall of the ethmoid, or the wall of the sphenoid and the posterior wall of the ethmoid may be separated by the so-called sphenoethmoidal recess.

With this visualization and conception of the ethmoid and sphenoid areas, the one comprehensive method of surgical attack, in my opinion, is the Sluder technic, as it leaves the grund lamellen and interturbinalen gangen more intact than any other; gives the surgeon at least five guides instead of one; proceeds from danger areas to zones of safety; and is a clean cutting operation, not a tearing bruising curettement, and may be made as conservative or radical as necessity demands.

DR. A. H. ANDREWS, Chicago: There are three points I wish to make. First, I wish to agree with the author in what he said regarding the preservation of the middle turbinate. Second, I would like to warn against packing these cavities after operation. Third, regarding the cause of continued suppuration after the cavities have been cleaned up, drained, medicated, or what not. The suggestion was made that possibly some of these cases might be tuberculous. Having had a good many that failed to recover when I thought they should, and having tried many things without success, I used the tuberculin test in four cases during the past month and got a positive reaction in every one. I do not know whether any of these cases are tuberculous. If they are I do not know how many. But I am going to make a series of experiments

both in the diagnosis and treatment with tuberculin which I hope some time to publish.

DR. F. J. PRATT, Minneapolis: If we know our anatomy and then have some external means by which we can visualize these cavities, it will help considerably. If a perpendicular line is drawn through the inner canthus of the eye and another perpendicular line drawn through the center of the nose, we have, between these lines, marked out the position of the cribriform space and ethmoid capsule. If we keep within this area and under the middle turbinate and work straight backward, there is no danger of entering the eye orbit. As we progress, the head should be tipped forward and we should follow along the natural contour of the frontal plate. The presence of the middle turbinate keeps us from entering the cribriform space. Then as we go back, the next thing is how far back are we? If we will take a perpendicular line at the temporo-orbital edge and one at the bony auditory canal, half way between these fixed points is the posterior wall of the sphenoid. So if you have your instrument in the nose and wonder where you are, just measure it with the end of your finger on the instrument against the tip of the nose, bring it out, lay it along the side of the head and see if it is half way between these two points, and if it is, you are at the back part of the sphenoid.

DR. H. V. DUTROW, Dayton, Ohio: I simply want to emphasize one point regarding the maxillary sinus. A great many men, and good men, too, are operating upon the maxillary sinus today by simple puncture and irrigation, trusting to luck that it will get well by that treatment alone. I wish to decry this haphazard way of dealing with this most important cavity. You cannot know enough about the anatomy within the sinus. One therefore should deal with it in a radical and fundamental way. Where you have established absolutely a diagnosis of chronic empyema of the maxillary sinus, it should be dealt with by the Caldwell-Luc or some other standard radical operation.

DR. H. B. LEMERE, Omaha, Nebraska: Doctor Mithoefer made the statement which appears frequently in discussion of antrum infection, that the antrum is a reservoir for pus from the ethmoids and frontals. I think this statement is open to question, especially as to its being the rule rather than the exception. Mechanically, the openings of the maxillary sinus in the erect position are placed at a tangent to the flow of the secretions which might be coming from above. In the recumbent position the openings will be in various relationship to the cavity of the antrum and the other nasal sinuses. The action of the cilia in the mucous membrane of the antrum have a tendency to protect it from entrance or secretion.

We have been perhaps prone to attack the ethmoid without very much evidence against it. A hyperplastic ethmoiditis has been considered enough evidence to operate on the ethmoid, yet we would hesitate for a long time before we would operate on the maxillary sinus on the same amount of evidence. Up to a few years ago it was my rule to operate on the ethmoid in noses that needed attention for low grade infection, cleaning out the ethmoid in a thorough manner. Most of these cases were merely improved, and many of them remained uncured. Some of these cases are now coming back, sometimes several years

after the initial operation. The ethmoid is still open and the frontal draining. On reexamination, in conjunction with the X-ray plates, I have often found low grade infection of the antrum unsuspected before. Acting on the hypothesis that the ethmoid should drain itself much more easily than the antrum, for the past three years I have chosen in low grade pansinus infection to operate first on the antrum, hoping that if the largest and remote sinus were thus open to treatment, the more accessible ethmoids might respond to the treatment of sprays and washes. The observation of my results over the length of time (three years) leads me to believe the hypothesis to be correct, and that the keynote to nasal infection is very frequently an infected antrum.

DR. JOSEPH C. BECK, Chicago: I want to offer a very severe criticism both of the paper, of the author, and of the gentlemen who have discussed it, because they are all able to recognize that there is another cause of failure which has not been mentioned, and that is the underlying pathologic condition of the tissues. Dr. Skillern said the thing to do is to wash out the antrum, and if there is no pus there is no antrum trouble. I am sure he does not mean that, for you can have an infection and inflammation, that is an osteitis, without an active suppurative process. There are no doubt many cases of osteitis without continuous discharge—true osteitis, not tuberculous or syphilitic, but an actual septic osteitis that is continuous and progressive, and no matter what the operation performed, it is the underlying true pathologic condition that is responsible for the failure, oftentimes a general condition as an anemia, etc., that is influencing the continuation of the suppurative process. I am sure we are all neglecting this study in the cases we are operating upon. Most of you remove something at most operations, no matter how little, and the little bit of tissue you take out will show you by the microscope whether it is a tuberculous, a syphilitic, or a suppurative process. I think that is an important point to bring out in the discussion of a valuable paper such as this.

DR. G. T. VON COLDITZ, Chicago: In spite of what Dr. Beck has said, I agree with Dr. Andrews in that merely opening and draining a sinus will not cure all cases, even if we have removed all the diseased tissues and obtained good drainings. Many cases will continue to suppurate. For the past three years, I have made a routine examination in all sinus cases consisting of bacteriologic examination, X-ray, Wassermann, and a tuberculin test. For the latter, I use one milligram of old tuberculin, intracutaneously. If there is no reaction, I repeat the test in five days using three milligrams, and if necessary, five milligrams in six days. In many patients I get a positive tubercular reaction, frequently accompanied by a focal reaction also. In these cases I use B. E. tuberculin, giving an injection every fourth day. After a period of a few months the patient's discharge will disappear.

DR. WILLIAM MITHOEFE (closing): Regarding the bacteriologic side of the problem, I cannot agree with Doctor Skillern, when he says that this is not of much importance. I believe that every patient ready for operation should have a bacteriologic examination made of the nasal discharge, and I would not operate in the presence of streptococcus hemolyticus unless urgent symptoms were present, and then I would do a very radical procedure. The simple removal of the middle turbinate in

the presence of a streptococcus hemolyticus infection may cause a meningitis. If meningitis cases following nasal operations were carefully reported, we would undoubtedly find that in most instances we are dealing with a streptococcus hemolyticus infection, and that such a simple procedure as a middle turbinectomy in the presence of this infection may be the cause of the meningitis.

The Wassermann test is always made as a matter of routine, especially if we consider the case an operative one. You will not fail in your operative procedure, if you weigh all the evidence before considering operation. Do not tell your patients it is a Wassermann; tell them you are going to make a complete blood test.

There are several important facts I would like to mention in closing. The first is, suppose you have done an intranasal antrum operation and the discharge of pus continues. In these cases always examine the ethmoid region, and in the majority of instances you will find an ethmoid involvement. In cases of recurring polypi, do not overlook the antrum. Third, if the ethmoid has been operated upon and you still have a continuance of the symptoms, do not hesitate to advise an external ethmoid operation. It is simpler than an intranasal operation if done under local anesthesia.

## EPIGLOTTIDECTOMY FOR THE RELIEF OF CON- GENITAL LARYNGEAL STRIDOR, WITH REPORT OF A CASE.

SAMUEL IGLAUER, B.S. M.D.

CINCINNATI.

Congenital laryngeal stridor is a rare condition, characterized by its onset shortly after birth, and by a peculiar inspiratory obstruction associated with a crowing sound. The stridor usually disappears during the second year of life. Dyspnea is usually absent, but there may be considerable inspiratory retraction of the lower thorax and at the sternal notch. On the other hand, asphyxial attacks may occur, and may at times be so severe as to cause death.

Thus Reardon,<sup>1</sup> reviewing 101 cases, found that "in seven cases death seemed directly due to the stenosis," while Blackader and Mucklèston<sup>2</sup> have found that one-sixth of the cases reported have died from affections of the respiratory system.

According to Thomson and Turner<sup>3</sup>, the infantile epiglottis is characterized by its soft nonresistant texture, and by more or less approximation of its lateral edges and of the aryepiglottic folds. This gives the epiglottis a peculiar trough or gutterlike shape. As the child grows, the epiglottis gradually becomes more rigid and elevated, and tends to unfold, so that by the seventh year it begins to assume the form of the adult epiglottis.

In cases of congenital stridor, most observers have found an exaggeration of the infantile type of epiglottis. In such cases, upon examination, the epiglottis could be seen to tilt backward during inspiration, while its lateral borders and the aryfolds frequently come into contact. The upper aperture of the larynx may thus be reduced to a slit like orifice with a rhomboid opening just anterior to the arytenoids. The stridor is probably due to the vibration of the aryfolds and the borders of the epiglottis.

Postmortem examination of the larynx in stridor cases shows that this deformity persists even after death, and it seems most likely that the malformed epiglottis is the cause of the symptoms. Jackson<sup>4</sup> states that occasionally the epi-

glottis of normal infants has a tendency to roll inward during inspiration, but considers the stridor cases a pathologic exaggeration of this phenomenon.

Lees<sup>5</sup> was the first to demonstrate such a larynx. The illustration of the specimen shows the epiglottis markedly incurvated, with its lateral halves, in contact with the laryngeal vestibule, reduced to a mere slit. Variot<sup>10</sup> demonstrated a similar specimen in 1898.

Judging from the illustration of Refslund's<sup>7</sup> case, the pathologic anatomy was almost identical with Lees' case. In the autopsy of Koplik's<sup>8</sup> case, a one-year old child, which died of pneumonia, showed a pronounced infolding of the epiglottis with its edges in contact. The lumen of the larynx seemed narrower than normal. An enlarged thymus was also found in this case. Variot<sup>6</sup> has recently made a unique observation. He found some abnormalities in the muscles of the larynx of a child fourteen months old, which had presented symptoms of stridor during life. The right cricoaryt. posticus muscle was entirely wanting, and there was slight atrophy of the right vocal cord.

CASE REPORT: About five months ago a pronounced case of laryngeal stridor came under my care. The case is of special interest because the infant was born in the hospital, where it was carefully observed by Dr. Blackfan and Dr. Higgins, of the Pediatric Service. Further interest is added by the fact that the infant had an enlarged thymus, to which the symptoms were first attributed. The thymus was treated by the X-ray, and as a result was diminished markedly in size, but the symptoms persisted. The child was sent home with instructions to report at the clinic at regular intervals.

The following abstract of the history prior to the time I saw the case is quoted from Dr. Blackfan's<sup>9</sup> records: "A colored female infant, weighing six pounds at birth. (Born in the hospital March 29th, 1921). Immediately following delivery it was observed that there was difficulty in breathing. There were marked inspiratory stridor and cyanosis. The dyspnea was constant and from time to time it became paroxysmal—being increased by crying and nursing. The paroxysms would begin with a series of inspiratory efforts followed by a loud crowing inspiratory sound, and then followed by a short expiratory effort. During this, there was marked retraction of the supra- and infraclavicular spaces and the intercostal spaces. There was an anxious expression of

the infant, the eyeball became prominent, and there was extreme cyanosis. On several occasions the attacks were so severe as to require artificial respiration.

The physical examination was negative except for an area of increased dullness in the region of the thymus. The dullness extended one and a quarter inches to the left and seven-eighths of an inch to the right of the midsternal line. It was continuous below with the cardiac dullness. This area of dullness disappeared when the infant's head was held in extreme dorsal flexion. It was also noticed that the symptoms were markedly relieved when this position was assumed. It was repeatedly observed that the symptoms could be induced and relieved by the position of the infant's head. When first seen, it was believed from the increased area of dullness that the symptoms were due to an enlarged thymus. The possibility of congenital malformation of the larynx was however considered. Inasmuch as the X-ray picture showed a shadow in the upper mediastinum indicative of an enlarged thymus, a series of X-ray treatments were begun. Although no marked improvement in the symptoms followed this treatment, the shadow in the X-ray entirely disappeared. Inasmuch as the infant was being breast fed and the paroxysms were less frequent, the patient was discharged after one month."

Ten days later, on May 4, 1921, while in the dispensary, the child suddenly became cyanotic, ceased breathing and required artificial respiration stimulation to restore it. On the following day I noted the following: Voice normal as manifested by crying. Respiration interrupted at times by laryngeal stridor with supra- and infraclavicular retractions and girdle like retraction of lower ribs. On direct examination of the larynx, the free borders of the epiglottis are drawn together at each inspiration and come into contact; at the same time the epiglottis is drawn backward into the larynx. Epiglottis appears to be flabby in consistence. Epiglottis closes like a book during inspiration. Arytenoids and vocal cords appear normal in structure and motion.

*Epiglottidectomy.* On May 6, 1921, without anesthesia, I suspended the patient, using a very short spatula made overnight especially for this case by Dr. Henry Freiberg. The epiglottis being exposed, the tip was seized with a small alligator forceps and a nasal snare passed over the epiglottis,

severing the free portion. There was practically no bleeding. The piece removed was rather soft and flabby, but showed no gross anomalies.

The child was able to swallow in a normal manner on the following day and thereafter. The stridor however did not disappear immediately, but persisted to a moderate degree for about two or three weeks after the operation. It gradually subsided, however, and no asphyxial attacks have occurred since the operation. External pressure on the larynx would excite some stridor, indicating perhaps some weakness of the thyroid and cricoid cartilages. Five months after the operation, the child breathes in a perfectly normal manner when quiet, but shows a slight retraction of the lower ribs when it cries loudly. The mother states that it has never had any difficulty in swallowing, and she has not noticed any stridor except when it has a cold. A very small epiglottic stump can be made out on direct laryngoscopy.

*Comment.* Since most observers agree that congenital stridor is due to a valve like infolding of the epiglottis, it seems to be a rational procedure to remove the epiglottis in all cases subject to asphyxial attacks. As is well known, the epiglottis can readily be dispensed with in older patients, and its removal apparently has no influence on deglutition even in infants. The persistence of some stridor for a few days after the operation described above is difficult to explain, but may have been due to the flopping of what was left of the aryepiglottic folds after the epiglottidectomy, or to some weakness in the skeleton of the larynx. At any rate, the stridor disappeared much sooner than could have been expected in the natural course of the disease.

As an alternative to epiglottidectomy, tracheotomy or intubation must be considered. Epiglottidectomy is a much simpler operation than tracheotomy with less risk to the patient, while intubation, even if efficacious, would require the wearing of a tube for many months.

So far as I can ascertain, epiglottidectomy has not hitherto been performed to relieve congenital laryngeal stridor. A review of the literature for the past twenty-five years (American Institute of Medicine) apparently contains no record of this operation for stridor. This is more to be wondered at since Variot<sup>10</sup> in 1898 suggested that cutting away the exuberant portions of aryepiglottic folds would probably relieve this condition, and Reardon (op. cit.), in 1907, made the further

suggestion that the removal of the incurvated portion of the epiglottis probably would give relief, if the prior removal of the epiglottic folds did not suffice.

#### BIBLIOGRAPHY.

1. Reardon, T. J. *American Journal of the Med. Sciences*, 1907, pp. 242-52.
2. Blackader and Muckleston. *Arch. of Pediat.*, 1909, v. 26, p. 401-16.
3. Thomson and Turner. *British Med. Journal*, vol. 2, 1900.
4. Jackson, Chevalier. *Peroral Endoscopy*.
5. Lees, B. B. *Transact. of Path. Soc. London*, 1883, vol. xxxiv, p. 19.
6. Variot, G. *Arch. de Med. Enf.* 1917, v. 20, pp. 530-34.
7. Refslund. (Quoted by Thomson and Turner.)
8. Koplik. *Arch. of Pediat.*, 1905, v. 22, pp. 881-89.
9. Blackfan, K. D. and Little, K. *Amer. Journal of Child. Diseases*, as yet unpublished.
10. Variot, G. *Bull. et Mém. de la Soc. Méd. des Hôpitaux d. Paris*, 3 Semes. Tome 15, May 27, 1898.

#### DISCUSSION.

DR. EMIL MAYER, New York City: I dare say, if a vote were taken and the members present asked how many had ever seen a case of laryngeal stridor, not a half dozen hands would go up. In other words, it is a very rare condition. I have had occasion to see a very few cases, and I would like to relate one instance. A child about two and a half years of age was apparently well and running around the room, but was constantly crowing because of her stridor. Apparently she was not suffering any distress.

It has always been believed that this is due to an infolding of the epiglottis, and no doubt that is the condition—a malformation, an elongation and infolding of the epiglottis. I can understand why so little has been said about it. In the first place, the condition is rare, and it is only since the advent of the suspension laryngoscope that we are in position to watch it and to remove it. How could you have attempted a thing of that kind before you had suspension?

It is remarkable how well people get along without an epiglottis. It disturbs our previous knowledge of the functions of the epiglottis, but nevertheless it is a fact that adults get along very comfortably without it. I believe no one has ever removed the epiglottis for this condition, and the credit of originality is due Doctor Iglauder.

One thing the speaker mentioned, and that is the persistence of the stridor for two or three weeks after the operation. I think that can be accounted for in this way. It is not only the epiglottis that is involved, but all the muscles in the interior of the larynx become involved on account of this congenital condition, and very likely the stridor that persisted was due to this intralaryngeal condition.

DR. SAMUEL IGLAUER (closing): There is no doubt that the introduction of direct laryngoscopy will revolutionize the study of this condition.

As to the suggestion about the muscles, the case cited by Variot, where the muscles were congenitally absent on one side of the larynx, would indicate that perhaps there is some condition within the larynx which also accounts for the stridor.

## THE EAR (INCLUDING THE VESTIBULAR ORGAN).\*

PROF. J. VAN DER HOEVE.

LEIDEN, HOLLAND.

As I have to speak to Otolaryngologists as well as to Ophthalmologists, I of course looked for a subject in those parts of our knowledge which divide as well as unite the different branches of medical science, which we practice.

In doing so, the first things which appeal to our mind are the relations of the nose and accessory sinuses to the eye, because these cavities are so close to the orbit and optic nerve. The ear is so great a distance from the eye, that it seems nearly impossible that direct influence is exercised by one organ on the other, and yet I believe that the relations between the eye and the ear, at least when we include the vestibular organ, are of much greater importance to mankind than those between the nose and the eye.

We can divide our subject into four parts:

1. Diseases and intoxications which cause eye and ear symptoms.
2. Eye diseases which cause ear symptoms.
3. Ear affections which give eye symptoms.
4. Relations between the vestibular organ and the eye.

I will try to pass the three former quickly in order to spend the greater amount of my time on the last and most important one.

We all know, that there are a great many diseases and intoxications which cause eye and ear symptoms. Of the latter, we can for instance mention intoxications with chinin, optochin, salicyl, wood alcohol, etc.; of the former, the well known ones such as syphilis, especially the hereditary form, tuberculosis, scrofulosis, etc., but I only wish to fix your attention for a couple of moments on some lesser known and yet important diseases. In the first place on the syndrome of blue sclerotics.

You know that in 1901 Eddowes taught us in a very short publication the existence of a hereditary disease, in which the patients have a grey-blue to slate-blue color of the white of

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\*This paper was received too late for insertion in its regular order.

the eye, and suffer from brittle bones; that means that their bone fracture on the slightest occasion, such as putting on an overcoat, falling on a feather bed, etc.

Eddowes supposed that this was due to a lack of fibrous tissue. His communication was forgotten and later on the facts rediscovered, many authors describing a great number of pedigrees of this interesting disease without showing new facts, till about four years ago Dr. de Kleyn, of Utrecht, and I, found that when these patients got older, they grew deaf by otosclerosis or labyrinth affection.

About the same time, this fact was also discovered by an American named Bronson, who was then in Edinborough, since which time it has been investigated by different authors.

I am convinced that the sufferers from blue sclerotics have nearly always brittle bones and ear affection also, but in the pedigrees you will find that every afflicted person has blue sclerotics, many of them brittle bones and some of them deafness.

This may be caused by the fact that when blue sclerotics are present, it is observed immediately; brittle bones may pass unobserved when no traumatisms occur to the patients, and the patients become aware of the otosclerosis only at an older age.

The cause is a maldevelopment of the mesoderm.

There are other infirmities which may occur, such as arcus corneae juvenilis, sprains, weak ligaments, etc. The patients often are small, crooked persons; the girl whose picture I show here, had about 27 fractures of different bones, e.g., of the spinal column, the pelvis, legs, skull, etc. The most interesting feature is the affection of the auditory organ. You know that a few years ago we still thought that the inner ear could not be photographed with roentgen rays in such a way, that the photographs could be used for clinical purposes, but Dr. Stenvers of Utrecht taught us otherwise. You see here in a skeleton skull the inner ear made more visible by filling with lead, and here without it you can see clearly the cochlea, the semicircular canals, the cavum tympanum and the meatus auditorius internus.

On the next lantern slide you see the same in a normal living person, and here is the inner ear in a case of otosclerosis in a patient with blue sclerotics, where we find in place of the inner ear a black mass in which we can find only a few remains of the labyrinth.

We know that in these rare cases the relation of eye and ear is of some value, and so it is necessary when a patient comes to us with blue sclerotics, not only to advise him not to take a profession in which he is exposed to traumatism, on account of the brittle bones, but also to warn him that it is possible that his hearing will get worse when he grows older, so that professions in which acute hearing is a first duty, such as telegraphist, telephonist, marconist, etc., would better not be chosen.

In the second place, I wish to mention the eye affections which often are found in congenital deaf and dumb people: such as pigment degeneration of the retina, either in the form of the well known retinitis pigmentosa or in other forms.

It may be of some interest on this account to state, that on ophthalmoscopic examination I found in every specimen I could lay hands on of the congenital deaf and dumb animal race, the Japanese or Chinese dancing mouse, a pigment degeneration of the retina, sometimes in a form very much like a retinitis pigmentosa and at other times more like the end results of a chorioretinitis.

Though this fact is very easily ascertained by the ophthalmoscope, the histologic investigation is not so easy, but I hope we will be able to prove this fact anatomically too. Anyhow, both facts show a very intimate connection between retinal pigment and deafness.

There is still a third instance of a disease with eye and ear symptoms.

We know a peculiar disease under the name of tuberose sclerosis of the brain, in which as a rule idiotic, epileptic young patients have tumors and cysts in the brain, the heart, the kidneys, the thyroid gland, and the skin. I have observed that in this disease there may also be found tumors of the optic nerve disc and of the retina, till now unknown.

Now there is a second nerve disease which we know under the name of the disease of Recklinghausen, where there are multiple neurofibromata in the skin and the peripheral nerves, and even in the acoustic nerve.

Some neurologists, as e. g. Bielschowsky, think that both diseases are one and the same, only with different localization of the tumors, and consequently they speak about spongioblastosis centralis, peripheralis, and universalis.

Nieuwenhuys, on the contrary, is convinced that these diseases are two entirely different, well defined affections not to

be grouped together. A couple of months ago I examined in the clinic of Prof. Winkler in Utrecht a patient, who was deaf, had poor vision, and showed atrophy of many muscles. The diagnosis was made of meningitis with consequent deafness and muscle atrophy, but when Dr. Stenvers made X-ray photos of the inner ear to find out what was amiss, he found on both sides a considerable enlargement of the porus acusticus internus, which as you can see on these diagrams enlarged still more in the course of time.

So it was considered highly probable that the deafness was caused by a tumor of the acoustic nerve; the patient was re-examined, and they found some neurofibromas on his back and in the cubital area. The diagnosis was therefore changed to Recklinghausen's disease.

The right eye of this man had poor vision for many years, and there had been a retinal detachment. We found in the retina a huge mass, which looked like the result of a Coates disease, but it could also be a tumor mass. At the region of the optic disc there was a tumescence, which possibly could be a tumor of the optic disc. However, this eye was too much changed to make a reliable diagnosis. The other eye showed a choked disc (5 dipters), and also in the retina two small tumors ophthalmoscopically just like the tumors in the cases of tuberosc sclerosis of the brain.

Though the real proof can be given only by histologic examination of the eye, I am thoroughly convinced that this man has the same kind of retinal tumors as our patients with tuberosc sclerosis show.

If this proves to be true, it is highly probable that the disease of Recklinghausen and tuberosc sclerosis are the same affection, or are at least closely related, for it would be too improbable that such rare tumors would develop in different diseases. So you see how important again the eye and ear symptoms are. The ear disease lead to the diagnosis of the Recklinghausen disease, and the eye disease can perhaps help solve this neurologic puzzle.

2. About eye diseases causing ear diseases we will be brief, because I know only one: the sympathetic ophthalmia, which is said to be the cause of deafness.

The first who observed this fact, Snellen and others, thought the deafness was caused by a meningitis spreading from the optic nerve sheath, because they believed in Deutschman's theory of the migration of the sympathetic ophthal-

mia along the optic nerve sheath. Nowadays this theory has become more or less obsolete, and other theories receive more favor.

Peters, who believed that deafness is not a very rare occurrence in sympathetic ophthalmia, tries to explain the deafness by one of the modern theories, and he chooses Elschnig's theory, which says that sympathetic ophthalmia is an anaphylactic process following sensitization of pigment caused by the inflammation in the first eye. Now it is possible that in the same way as the pigment in the second eye, so also the pigment in the labyrinth is sensitized and causes the ear disease. The individual differences in the amount of labyrinthine pigment can explain why one case becomes deaf and another not.

I cannot say that I, personally, often found deafness in sympathetic ophthalmia, but this theory shows again how close a relation is thought to be present between eye pigment and ear, and I am thoroughly convinced that this relation is a very important one. So we often encounter deafness in albinotic animals, e. g., white cats. As a rule these cats have blue irides, which means that they are not absolutely albinotic, whereas total albinotic cats are not deaf. The same is the case with mice; totally albinotic white mice are not deaf, whereas the partially albinotic dancing mouse is deaf.

Concerning these relations between eye pigmentation and deafness, there are three different possibilities:

1. The pigment aberration causes the deafness;
2. The ear disease causes the pigment aberration;
3. Both are independent of each other, but may come from the same origin.

The first is perhaps the case in sympathetic ophthalmia. Concerning the second possibility, Peters suggests that the eye pigment may be sensitized from the labyrinth, giving rise to a spontaneous bilateral iridocyclitis; this supposition so far lacks proof.

Von Stein thought the relation between eye pigment and labyrinth is so close a one, that whenever in guinea pigs he destroyed one labyrinth he observed pigment changes in both eyes. Von Stein by destruction of the cochlea could cause pigmentation or depigmentation of the eye, so that he supposed a trophic center for the eye to be present in the cochlea.

I cannot believe the relation between ear and eye pigment

to be so close and simple, because in a great number of guinea pigs, rabbits and cats, in which for another reason one labyrinth was destroyed, Dr. de Kleyn and I could never observe changes in eye pigmentation, either immediately after the operation or weeks or months later. We had the same negative results in observing human beings where the labyrinth was destroyed by diseases, so that we came to the conclusion, that pigment changes in the retina may be found in congenital labyrinth deafness often, but in acquired only very seldom, and that up to now it has not been proved that the pigment changes are dependent on the ear diseases.

So we are already in the midst of our third part, the influence of the ear on the eye. Here I will not speak about the choked disc due to acoustic tumor or otogenic encephalitis or meningitis, but will mention some other diseases, in the first place the thrombosis of the sinus cavernosus. Every ophthalmologist should always bear in mind, that this usually deadly disease may have its origin in an otitis, so that as soon as we can make the diagnosis of this terrible disease or think about it, we ought to consult with an otologist, because as I know from experience, operation on the ear may sometimes prevent the fatal issue.

Another eye symptom caused by an ear disease, which occurs more frequently, is the paralysis of the abducens nerve in otitis media. Some time ago I saw a most striking instance of abducent paralysis caused by otitis media. A village doctor sent a boy with palsy of the right sixth nerve, and stated that he had observed purulent secretion in the right ear. When the boy came to Leiden, the purulent secretion had stopped entirely, and the otologists could find not the slightest symptom of otitis media, even no scar or perforation in the tympanum. The boy was taken into my ward. Two days later the purulent secretion reappeared, and the paresis was much better; a very small perforation was observed in the tympanum; the secretion stopped again, the paresis become worse; this happened several times.

What is the relation between the palsy and the otitis? Gradenigo thought about a meningitis at the tip of the os petrosum; others speak about pressure exercised by inflammatory edema and venous stasis in the narrow slit of Dorello, where the nervus abducens comes into relation with the sinus petrosus superficialis. I, personally, believe that toxins play a part, also, by spreading of the toxin in the neighborhood of

the hearth, so that, as soon as the free exit of the pus was blocked the paresis become worse from toxic edema. It is like the affection of the optic nerve in disease of the accessory sinuses, and like eye affections of dental origin.

To my mind, it is a little absurd to suppose that the toxins are absorbed by the fluids and circulate through the body to come exactly to the spot next to the hearth, to exercise their pernicious influence.

It is much more probable, and quite according to the fact that the least obstruction causes immediate exacerbation, to suppose that the toxic influence comes directly from the toxins spreading in the neighborhood of the hearth.

The combination of ear disease and abducens palsy may also be found in cases of traumatism, so I show you here the roentgenogram of a man, who after a trauma of the head was deaf and had an abducens paralysis; we see a fracture in the os petrosum passing through the cochlea.

If, as we know, an otogenic pupillary and an aural palpebral reflex exist, I think we are aware, that in daily practice many relations between eye and ear may be found worthy of our vivid interest, of which it is necessary to be always aware in the interest of our patients and ourselves.

Much more important than these direct clinical relations of the real auditory organ and the eye, are those between the eye and the vestibular organ. Though many of them have already found a place in our daily practice, they are not only of clinical interest, but also of high scientific significance both from a physiologic and from a pathologic point of view.

#### VESTIBULAR ORGAN AND EYE.

The inner ear is composed of two different parts, which do not belong to each other though both are innervated by branches of the acoustic nerve; the real auditory organ, the cochlea innervated by the nervus cochlearis, and the vestibular organ innervated by the nervus vestibularis. Formerly the vestibular organ was thought to be a part of the auditory organ, and many a name still reminds us of this mistake. Since the classic experiments of Flourens, however, we know that the vestibular organ is a part of the organ of equilibrium, and it is only the very close and intimate anatomic relation which gave this organ as a precious treasure to the otologists, though it has become the place of great mutual interest and

the favorite working place of physiologists, neurologists and ophthalmologists as well as of otologists.

The vestibular organ consists of the three semicircular canals and the two spaces which we call the utricle and the saccule. In the ampullae of the semicircular canals, we find the cristae acusticae, which are the waving hairs, moving with the motions of the lymph in which they are floating. Every movement of this fluid acts as an excitation to the nerve cells, so that those canals are a most excellent apparatus for perceiving every motion of the head.

In the saccule and utricle, we find the maculae acustical nerve cells, on which rests a membrane with calciferous impregnation, the so-called otolith membrane, which in some animals, e. g., fish, is so developed, that we can speak of a real stone, the otolith.

The otoliths can exercise influence on the maculae by pressing on the nerve cells or by pulling at them, consequently the stimulus which they cause will change with every change in position of the otolith organ, and thus the otoliths are an excellent organ to perceive every different position of the head in space. Numerous theories have been brought forward and experiments done to explain the function of the vestibular organ and I have only to mention the name of Flourens, Mach, Breuer, Ewald, Kreidl, Kubo and recently Bárány. You know how Bárány made our knowledge about the function of the vestibular organ available for use in daily practice.

I think that among the very best work which has been done on this subject belongs that of the last 10 years in the pharmacologic laboratory in Utrecht, by Magnus and de Kleyn with their cooperators. This work is so important, that Bárány himself is always in correspondence with these Utrecht men, to learn whether his hypotheses are confirmed by the fine experiments made at that place.

In the time which remains to me, I wish to tell you what Magnus and others found.

The experiments were made on animals—frogs, cats, dogs, guinea pigs, and especially rabbits—with the intention, when they had obtained an exact knowledge of the function of the vestibular organ in these animals, of trying to acquire similar information in human beings, where the circumstances are so different.

The first thing which was necessary, was to become thor-

oughly acquainted with the anatomy of the vestibular organ of the rabbit.

In the anatomic cabinet in Utrecht Dr. de Burlet made serial slides of rabbit skulls, reconstructions in wax of skulls and membranous labyrinth, and on the slides was made a mathematically drawn reconstruction, which was controlled by Prof. Ornstein with an analytic geometric formal system. In this way there was obtained an exact knowledge of the anatomy of the labyrinth of the rabbit.

A magnified model of the labyrinth was constructed according to the result of this examination. It was too big to bring with me, but I can show you here a model of the otolith apparatus, which represents their real position in the rabbit skull. The maculae acusticae are represented by these coloured plates, the otoliths by these leaden ones. You see that in giving the rabbit skull different positions in space, we can see what the position of the otolith is in any position of the skull.

We know that the labyrinth can cause clonic and tonic reflexes on the eye muscles, so that nystagmus is produced by the clonic, whereas the position of the eye in the orbit is determined by the tonic reflexes. Now Magnus and de Kleyn found that the labyrinth produces also tonic reflexes on the body muscles, and they tried to determine which reflexes were produced by the different parts of the vestibular organ. They found, that the vestibular organ causes a tonic contraction of the extensors of the limbs, maximal when the head of the rabbit was placed upside down, minimal when the head had its normal position, with the mouth fissure horizontal.

This reflex was ascribed with high probability to the utricle otolith, so that we see the otolith causes the maximal extension of the limbs when it is dragging at the macula, and no extension when it is pressing on the macula. The same otolith causes also extension of the neck muscles, with of course the same maximum and minimum positions, but there is an important difference between the two reflexes.

The utricle otoliths are in contact with the limbs of both sides, so that when one labyrinth is destroyed the reflex remains the same in quality.

Concerning the neck muscles on the contrary, every otolith is in relation with the muscles of only one side, so that when one labyrinth is destroyed, the reflex causes bending of the neck.

A third labyrinth reflex has as a consequence that the animal tries to bring back his head into the symmetric medial position as soon as it has left this position. Magnus calls these reflexes "Stellreflexes."

They are probably caused by the main part of the sacculus otolith. Every sacculus otolith awakes a reflex, which tries to press the head in a direction opposite to the otolith. As long as the head is in the symmetric medial position, the influence of each otolith counterbalances the other, but as soon as the head is bent to one side, the otolith of that side is dragging stronger and so stimulating more, and the other is dragging less and so stimulating less, so that the lowest otolith gets the most influence and presses the head back again into the symmetric position, which it cannot pass, for in that case the influence of the other gains in strength as much as the first one loses. If one labyrinth is destroyed, the influence of the remaining sacculus otolith is no longer counterbalanced, and it will press the head to the other side, until the head acquires a horizontal position with the side of the remaining labyrinth above. Now the sacculus otolith presses on its macula, and no longer drags, so that this is the rest position, which was already seen in Flourens's experiments.

These reflexes have not only theoretic importance, for we can find them under certain circumstances in human beings, and they may be used for diagnosis. The reason why these reflexes are very difficult to find in animals, and are almost not to be observed in human beings, is that they are hidden by voluntary movements and by other consequences of brain action.

Therefore we can best find them in animals, when they are decerebrated. In human beings we find them when the brain does not act properly, e. g., in some children younger than 3 1/2 months, or when the brain is partly diseased. Magnus and de Kleyn have studied the path the reflex arc takes, and so we can conclude, when the reflexes are present, which part of the brain is still acting. These reflexes were found in patients with idiocy, meningitis, hydrocephalus, apoplexy and coma diabeticum. As a rule, it is an ominous sign in brain disease when these reflexes can be observed.

But I should speak about the relation of the eye and vestibular organ. We said that the vestibular organ can cause tonic and clonic contractions of the eye muscles. The first determine the position of the eye in the orbit.

Dr. de Kleyn and I tried to find out what are the different positions of the eye in the orbit, when the head changes its position in space.

For this purpose we marked the cornea of a rabbit with a cross figure and suspended the rabbit on an operation board, the head fixed firmly in a Czermak clamp. At this clamp was fixed a wire figure, so that when we photographed the cornea we could see by the cross figure and the wire figure if and how much the cornea had moved. The photographic apparatus was fixed on the same board.

This operation board was fixed in a wooden frame in such a way that it could rotate on an axis, and the frame again in another frame, so that it could rotate along an axis perpendicular to the first. In this way we could give the head of the animal every position in the space we wished.

When we turned the whole apparatus around a vertical axis the position of the eyes was not changed at all.

We made now three rotations:

*Rotation I.* Animal in vertical position, mouth fissure horizontal. Rotation of the animal on its bitemporal axis. Direction of rotation head down, tail up.

*Rotation II.* Vertical position, mouth fissure horizontal. Rotation of the animal on its occipito-caudal axis.

*Rotation III.* Animal in lateral position, mouth fissure vertical. Direction of rotation head down, tail up.

We made 25 photographs for every rotation of  $360^\circ$ . The animal was moved every time  $15^\circ$ , and we waited till the nystagmus caused by the movement was over. At the 25th determination, the animal had come around again to its original position, so that the 25th photograph controlled whether no change of the position due to other factors had taken place. It is clear that many of the positions in the three series are the same, and so they controlled each other.

In this way we learned that by changing the position of the head in space, the eyes deviate typically in vertical directions and rotate along the sagittal axis. We could not find any typical horizontal deviation.

You see that the vertical deviation has its maximum when the animal is rotated on his side. Then the eye of that side is as high as possible, and the eye of the upper side as low as possible. De Kleyn and Magnus explained this by actions of the main part of the sacculus otolith. Every sacculus otolith is in connection with the rectus superior of its corresponding,

and the rectus inferior of its opposite eye. As long as the head is in a symmetric position, the influence of the muscles counterbalance each other, and so we see no or nearly no vertical deviation, when the animal is rotating around the bitemporal axis.

When, however, the animal leaves the medial position, the lower sacculus otolith drags more at its macula, the upper less, consequently the eye of the lower side is turned up, and that of the upper side turned downward.

If one labyrinth is destroyed, the influence of the remaining sacculus otolith is not counterbalanced, and the eye of the mutilated side is turned down, and of the healthy side upwards. When the head is rotated on the mutilated side, so that the remaining sacculus otolith presses on its macula and exercises consequently no influence, the eyes return to the normal position.

The rotation of the eye, the cyclotropia, is maximal with the summit of the vertical to the nose when the nose is turned upwards, maximal with the summit to the ear, when the nose is turned downwards. It was difficult to find out which otolith produces this reflex; neither the utriculus nor the main part of the sacculus otolith can do it. Now Magnus and de Kleyn tried to explain it by action of the small bent part of the sacculus otolith. This part has not only a separate position nearer to the frontal plane, but also a separate innervation; whereas the main part of the macula sacculi is innervated by the nervus sacculus, this part is innervated by the nervus utriculus, so that it is no wonder that it has a separate action too. When the head is rotated with the nose vertically up in the air, the small part of the sacculus otolith drags at its macula and gives a stimulus to the musc. obliq. sup. of both sides, so that the eyes rotate to the nose. When the head is rotated with the nose pointing downwards, these otoliths press on their maculae, and this produces a stimulus for the obliquus inferior of both sides. When one labyrinth is taken away, the reflex is the same in quality but not in quantity. The weak point of this explanation is that we have here for the first time to accept pressing on the macula as a stimulus, but it is possible that this explanation is good, though I have some other objections too.

This rotating reflex is called the compensatory rotation, because it seems to try to compensate the rotation of the head by the rotation of the eyes. That really the labyrinth is the

cause of these deviations is proved by the fact, that when we destroy both labyrinths, the compensatory and vertical movements have disappeared when we examine the influence of the head movement without bending the neck of the animal.

I have been able to show that these reflexes fail in the congenital deaf dancing mouse and also in two congenital deaf and dumb girls. For the examination of the latter I used a Javal ophthalmometer with a rotatable head rest, in which the head was fixed. We first determined the axis of the astigmatism of the cornea, and then we rotated the head with the head rest, e. g.,  $10^\circ$ . If there was no compensatory rotation, the axis of astigmatism was rotated  $10^\circ$ ; if there was compensatory rotation of  $10^\circ$ , the axis would not have changed; if the axis was changed  $3^\circ$  there must have been  $7^\circ$  compensatory rotation, so we can determine exactly the compensatory rotation in astigmatic human beings, and in doing so we find that even the least rotation of the head produces compensatory rotation. This is of importance for the ophthalmologists, for it teaches us that we always have to put our patients with their head straight in the ophthalmometer, otherwise we do not find the right axis. This compensatory rotation is probably also the reason why astigmatic people often hold their head rotated to one or the other side, when they do not get the right correction. They try by this movement to rotate their eyes in such a way that they get their eyes in the best position behind their glasses.

We who like to know the why of things ask ourselves what is the purpose of this compensatory rotation? When this rotation was observed years ago, they thought it was to hold the vertical meridian of the eye vertically in every position of the head for better orientation, but this could not be accepted, because the compensatory rotation was always less than the rotation of the head.

In rabbits it is, as you saw the same, but we know that there is another influence, which gives compensatory rotation of the eyes, namely a reflex produced by the neck muscles.

When the neck of a rabbit is bent, the eyes rotate. Now de Kleyn examined both separately. The compensatory rotation caused by the neck, by fixing the head and bending the body of the animal towards the head. The labyrinth rotation reflex was examined by us as described above. If now de Kleyn put both compensatory rotations together, he learned, as you see, that a rabbit with the mouth fissure horizontally,

head straight forward, can lift his head over  $10^\circ$  and bend it downwards over  $90^\circ$ , without rotation of the eye; because the compensatory rotations compensate fully the rotations of the head.

At first de Kleyn was puzzled, why this compensation allowed the head to bend more than  $90^\circ$  and only to lift  $10^\circ$ , but this was solved easily. It is caused by the fact that the normal position of a sitting rabbit is not with the mouth fissure horizontally, head straight forward, but with the head bent downwards  $35^\circ$ , so that out of this position the animal can lift the head over  $45^\circ$ , and bend downwards over more than  $55^\circ$  without the vertical meridian of the eye changing its direction, which is quite enough for orientation in looking for his food.

So we see that in rabbits the compensatory rotation corrects the influence of the rotation of the head fully, and it is probable that in mankind it is an atavism.

About the highly interesting problem of the vestibular nystagmus I must be brief, and will speak only about one point.

You know there are many excitations which produce vestibular nystagmus. One of them is the irrigating of the ear with cold water, the so-called cold water nystagmus.

Bartels holds that this is caused by elimination of the labyrinth by the cold, so that the same nystagmus is produced as if one labyrinth was destroyed. Bárány on the other hand thinks it is caused by a stream of endolymph in the semicircular canals brought about by local cooling of the labyrinth wall. This cools the lymph at that spot, consequently this fluid gets heavier and it flows off towards the lowest part of the semicircular canal. The lymph stream stimulates the sensory epithelium of the ampulla, and causes in this way the nystagmus.

At first Magnus and de Kleyn investigated whether such a great influence as paralyzing a nerve in the ear can be exercised by the cooling of the ear. Now de Kleyn had discovered that in cats the sympathetic nerve for the eye ran through the middle ear, and they observed that irrigating the ear with cold water caused a palsy of this nerve in cats, narrow pupil, narrow eye slit, etc., consequently Bartels' explanation is possible, but de Kleyn and Storm van Leeuwen could prove it is not right, because the nystagmus does not act in the same way as the nystagmus after labyrinth extirpation. Later,

those two investigations proved that Bárány's theory was correct, in the following way:

De Kleyn and Storm van Leeuwen thought that if Bartels is right, the nystagmus would be the same in whatever direction the head is held; if, on the contrary, Bárány is right, there would be an ampullapetal lymph stream when the ampulla is lower down, an ampullafugal stream, when the ampulla is higher up than the cooled spot; no stream when the whole canal is horizontal; that means that the nystagmus must change abruptly its direction, when the cooled spot crosses the position in which it is on the level of the ampulla.

To examine this, de Kleyn and Storm van Leeuwen used our rotating operation board and irrigated one ear of a rabbit during the rotation with cold water; they noted the direction of the nystagmus down after every  $10^\circ$  of rotation, so that the rotations of  $360^\circ$  gave 37 notations. You see here the result, which is corrected from the influence of the change of the direction of the musc. rectus internus and externus by the rotation.

In none of our three rotations is the spot reached where the horizontal canal is really horizontal, but we can reckon where the nystagmus must change its direction and you see the result is very near to what was calculated before.

In this way it was proved that Bárány's explanation is right. In the genesis of cold water nystagmus, the cooling down of the horizontal semicircular canal plays the principal part.

When we pass in review the different functions of the vestibular organ, we find: tonic reflexes on the body and neck muscles "Stellreflexes;" tonic and clonic contraction of the eye muscles.

We assume that the tonic reflexes are caused by the otolith apparatus, the clonic by the semicircular canals, but up to now this has never been proved experimentally.

Always when they tried to take away the otoliths, the whole vestibular organ was destroyed, and the same was the case when they tried to perforate and drain the semicircular canals only. Now de Kleyn remembered that Wittmaak had published experiments in which he put guinea pigs in a centrifuge and revolved them about 2,000 rotations in a minute. The centrifugal power was so great that the otolith membranes were torn and thrown away from the maculae.

Magnus and de Kleyn made use of this. They examined

a great number of guinea pigs for every vestibular reflex, then narcotised them, put them in the centrifuge and revolved them for two minutes, 1,000 rotations per minute. As soon as the guinea pigs awakened from the narcosis they were again examined for the vestibular reflexes and this examination was repeated for a couple of days until no further change was noted. Then the animals were given to the anatomist who examined the labyrinth in serial slides.

Magnus and de Kleyn had made the clinical diagnosis of what had happened in the labyrinth, which otoliths were torn and thrown away. The anatomist made the anatomic diagnosis. They knew nothing of each other's diagnosis till they compared them, and in nearly every case the clinical diagnosis proved to be right.

I can show you here microphotos of normal otolith apparatus of the rabbit, of otolith membranes thrown away, of torn up otolith membranes which were partly thrown away, and partly remained in their places, of vestibular organs with large hemorrhages after the centrifuging, and after some experience nearly all diagnoses could be made clinically.

In this way, for the first time, was proved what was the function of the otoliths, and what of the semicircular canals, and was really stated that otoliths are the organ for the reflexes of position, the semicircular canals for the reflexes of movement.

There was only one surprising fact. The reflexes of progressive movements, such as lift movements, etc., proved to be caused by the semicircular canals, whereas Breuer had always said this to be absolutely impossible and every one had believed him.

Magnus and de Kleyn have suggested an explanation for this fact, but it would take me too long to speak about this too.

We cannot say with absolute certainty whether the explanation of the action of every particular otolith which Magnus and de Kleyn gave is right, but we know these explanations to be probable, and the facts on which they are based to be true. Others try to explain the otolith action in another way, e. g. Quix, who explains it by taking only the pressing of the otolith on its macula as the acting stimulus.

Mr. Chairman, Ladies and Gentlemen: In the first part of my address I recalled to your memory the manifold relations between eye and ear, which we may encounter in daily practice; in the second I dealt with one of the most difficult prob-

lems of medical science and therefore I do not flatter myself, that every one of you will have understood everything I tried to express, but I am certain I gave you something to think about. You saw that we are not at the end, that after every solved problem new questions arise, which await their solution, but I hope you are convinced with me that we are on the right track, and will by going on in this way come to know as much of the functions of the vestibular organ and as much of the relations between labyrinth and eye as is given to human beings to know.

#### DISCUSSION.

DR. KEIPER, Lafayette, Indiana: Mr. President: We have listened to a most magnificent address. We have not adjectives enough to express our appreciation; but I wish to make a motion that we extend to Prof. van der Hoeve and to the Council our sincere thanks for this magnificent address, and that we take this by a rising vote.

The motion was seconded.

CHAIRMAN: There is a motion that our thanks be extended to Prof. van der Hoeve for his masterly scientific address.

Vote taken rising, amidst great applause.

THE CHAIR: Members of the Academy, I have now the honor to present to you Professor Ernst Fuchs, of Vienna, who is with us at the present time. Learning that he was in this country at the time the Academy was about to meet, I asked him to join us at our meetings and take part in our discussions. I take great pleasure now in presenting to you Prof. Ernst Fuchs. I need not say to you Prof. Fuchs is a man whom many of us call "master," and all of us call "friend." (Great applause, rising.)

## PRESENTATION OF A MERCURY TONOMETER.

MARTIN COHEN, M.D.,  
NEW YORK CITY.

This instrument does away with any mechanical device and gives us an accurate and direct manometric reading of the intraocular pressure. It is held perpendicularly, and placed on the center of the cornea. The mercury column is balanced by the weight of the instrument, excluding its han-

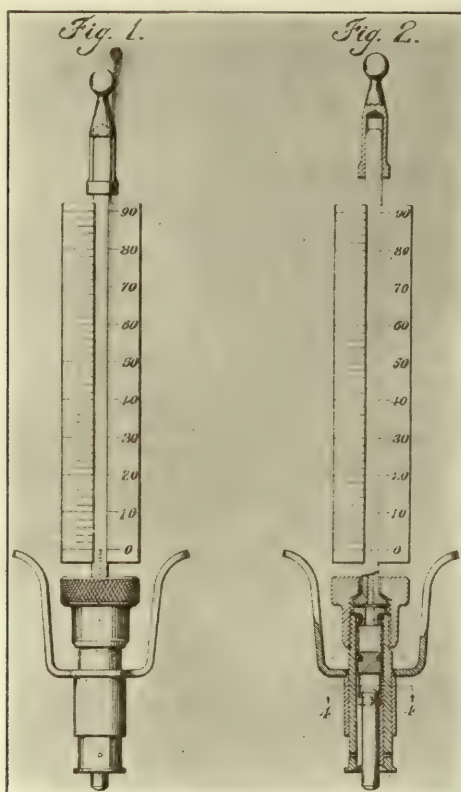
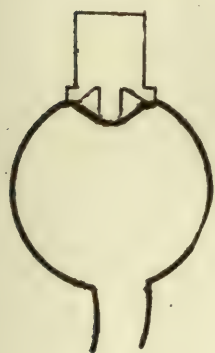


Fig. 1.

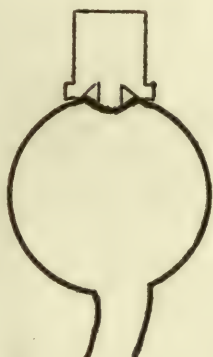
dle, at a reading of 92 degrees on the scale. The capillary glass tube is attached hermetically to a reservoir of mercury which is encased in a fish skin. The corneal plate is so constructed as to allow for a complete reading, as its angular

portion registers the higher readings, thereby eliminating added weights.

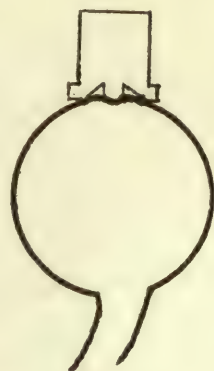
The average normal reading has been accepted at 20 m.m. mercury, after the examination of over 100 normal intraocular pressures. In incipient glaucoma this instrument has been of



*Fig. 2 .*



*Fig. 3*



*Fig 4*



*Fig. 5.*

exceptional value. A more detailed description of the instrument has been published in *The Archives of Ophthalmology*, Vol. 50, No. 4.

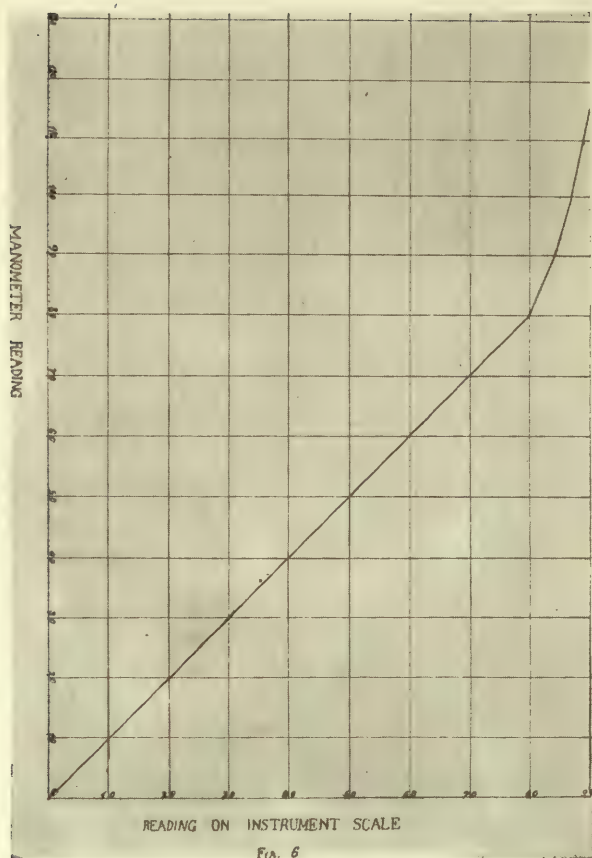


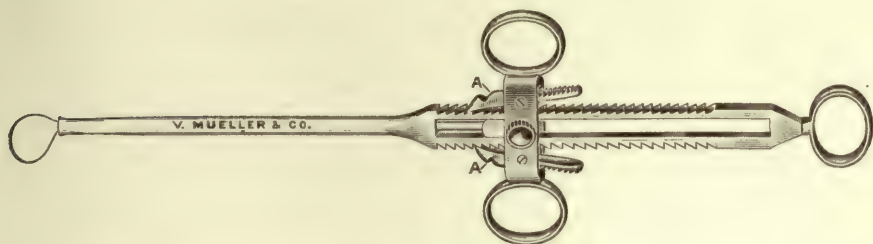
Fig. 6.

## A NEW TONSIL SNARE.

HORACE NEWHART, M.D.

MINNEAPOLIS, MINNESOTA.

The tonsil snare which is here presented, is an improved, simplified modification of the original Bruenings' model. It embodies the principle of the double ratchet and lever, enabling the operator to secure great crushing power with little effort, and insuring positive action even in a very fibrous tonsil with a large pedicle.



Instead of utilizing a specially soldered wire loop to fit a notch in the stylet, we have substituted an ordinary No. 8 piano wire snare. Should the springs forcing the fingers against the teeth of the shaft break, an immediate temporary repair can be made by the use of a rubber band stretched over the fingers and held by the groove for this purpose. The shaft and canula are all in one piece, and the removal of a single screw makes it possible to pull out the stylet for cleaning.

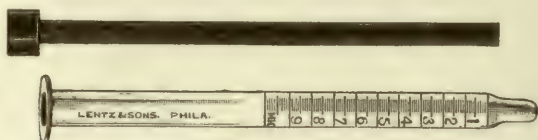
Because of its simplicity, lightness and ease of manipulation, it has proved a most serviceable instrument in our hands during the past five years.

## A NEW SLIDING DOSE TUBERCULIN SYRINGE.

EDWIN B. MILLER, M.D.

PHILADELPHIA, PA.

In 1918 I began the preparation of a paper entitled "Corneal Disease of Tubercular Origin, Its Diagnosis and Treatment by the Use of Tuberculin," which I read before the Pennsylvania State Medical Society, September, 1919. Because of the difficulty we all experience with tuberculin dilutions and syringes, I worked out a table of dosage and tried to devise a syringe to suit it. Getting in touch with the manufacturers of glass syringes and submitting to them a drawing, I was much surprised when they informed me that it was impossible to construct a syringe upon the lines suggested. Therefore, I was unable to have a syringe made to exhibit at the State Society meeting.



I kept following the matter up, however, and just a day or two before the meeting of the Academy, I received from the manufacturers a syringe which is built on the lines laid down in 1918. This syringe is graduated in minimis and tenth minimis up to ten minimis, and this enables you to arrange your dosage more accurately and with greater flexibility.

The manufacturers of tuberculin tell us that two minimis of their first dilution is equivalent to 1/1000 of a milligram of Kochs Old, and 1/10000 of a milligram of Tuberculin Rückstand, and advise you to increase the dosage one minim at an interval of four days. This is what I call the skip-stop method, and those of us who have used it to any large extent know that we frequently get sharp reactions, for the increase in dosage is too rapid.

This new syringe which I now show you, enables us to arrange an accurate dose in milligrams, and by its use with the table presented, the dose is increased so gradually, that you avoid getting a reaction.

I have used this method of dosage since 1918, in about 250 cases, with gratifying success. I have with me some copies of the dose table which I will pass around. As you see 2 minims equal 1/1000 milligram; 2.2 minims equal 1/900 milligram; 2.5 minims equal 1/800 milligram and so on down the line. You will notice also that the maximum capacity of the syringe is 10 minims. When you have reached this point you begin on dilution No. 2, in which 2 minims equal 1/100 milligram and begin running it up to 10 minims, starting then with dilution No. 3 and so on.

## TABLE OF DOSES

## KOCH'S OLD TUBERCULIN DILUTIONS.

No. 1.		No. 4.		No. 4—continued	
2	M—1/1000 mg.	2	M—1 mg.	9.5	M—4¾ mg.
2.2	M—1/900 mg.	2.5	M—1¼ mg.	10	M—5 mg.
2.5	M—1/800 mg.	3	M—1½ mg.	10.5	M—5¼ mg.
2.8	M—1/700 mg.	3.5	M—1¾ mg.	11	M—5½ mg.
3.3	M—1/600 mg.	4	M—2 mg.	11.5	M—5¾ mg.
4	M—1/500 mg.	4.5	M—2¼ mg.	12	M—6 mg.
5	M—1/400 mg.	5	M—2½ mg.	12.5	M—6¼ mg.
6.5	M—1/300 mg.	5.5	M—2¾ mg.	13	M—6½ mg.
10	M—1/200 mg.	6	M—3 mg.	13.5	M—6¾ mg.
No. 2.		7	M—3½ mg.	14	M—7 mg.
2	M—1/100 mg.	7.5	M—3¾ mg.	14.5	M—7¼ mg.
2.5	M—1/80 mg.	8	M—4 mg.	15	M—7½ mg.
3.3	M—1/60 mg.	8.5	M—4¼ mg.	15.5	M—7¾ mg.
5	M—1/40 mg.	9	M—4½ mg.	16	M—8 mg.
10	M—1/20 mg.			16.5	M—8¼ mg.
No. 3.				17	M—8½ mg.
2	M—1/10 mg.			17.5	M—8¾ mg.
2.5	M—1/8 mg.			18	M—9 mg.
3.3	M—1/6 mg.			18.5	M—9¼ mg.
5	M—1/4 mg.			19	M—9½ mg.
10	M—1/2 mg.			19.5	M—9¾ mg.
				20	M—10 mg.

## TUBERCULIN RÜCKSTAND.

No. 1.		No. 3.	
2	M—1/10,000 mg.	2	M—1/100 mg.
2.2	M—1/9,000 mg.	2.5	M—1/80 mg.
2.5	M—1/8,000 mg.	3.3	M—1/60 mg.
2.8	M—1/7,000 mg.	5	M—1/40 mg.
3.3	M—1/6,000 mg.	10	M—1/20 mg.
4	M—1/5,000 mg.	No. 4.	
5	M—1/4,000 mg.	2	M—1/10 mg.
6.5	M—1/3,000 mg.	2.5	M—1/8 mg.
10	M—1/2,000 mg.	3.3	M—1/6 mg.
		5	M—1/4 mg.
		10	M—1/2 mg.
No. 2.		No. 5.	
2	M—1/1,000 mg.	2	M—1 mg.
2.5	M—1/800 mg.	2.5	M—1¼ mg.
3.3	M—1/600 mg.	3.3	M—1½ mg.
5	M—1/400 mg.	5	M—2 mg.
10	M—1/200 mg.	10	M—5 mg.

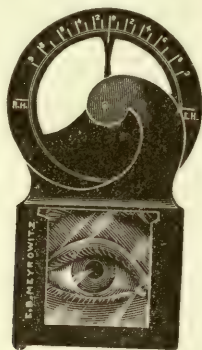
## A HANDY PHOROMETER.

DAVID W. WELLS, M.D.

BOSTON, MASS.

About twelve years ago I devised this apparatus. The *Handy Phorometer* consists of a ten degree prism attached to a weighted disc, which acts on the principle of a plumb bob to indicate when the base-apex line of the prism is exactly vertical or horizontal. The prism base down gives rise to a vertical diplopia, and if there is no horizontal heterophoria, the two images will be in the same vertical line, in which case the instrument will register zero. If out of vertical, the prism is tilted until verticality is secured, and the eso- or exophoria read off on the scale.

When the prism is held base in, a horizontal diplopia is produced. If there is no hyperphoria, the instrument registers zero. If the prism requires tilting to acquire horizontality, the amount is registered. The scope of the instrument is 8 to 9 prism diopters or  $8^{\Delta}$  to  $9^{\Delta}$ . It is not intended to do the work of more elaborate instruments, but in order to "rough out" a case; also to use outside of one's office.



It must, of course, be marked for one eye or the other, and cannot be right for both. This one is intended to be held before the left eye.

In 1907 Meyrowitz made this model to sell for ten dollars. It is a great improvement on the rough model which I made for myself.

I published a description in 1908, but I think it has never been shown at any society meeting.

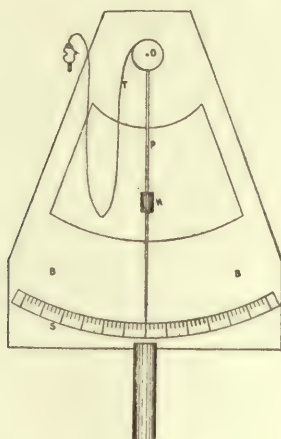
METHOD OF MEASURING THE STRENGTH OF THE  
INTERNAL RECTUS.

LUCIEN HOWE, M.D.

BUFFALO, NEW YORK.

Attention was first called to the fact that in every attempt to correct an apparent or latent deviation of the eyes, the most important thing is to ascertain whether the globe turned, or tended to turn out of place because one group of muscles was abnormally strong or because the opposite group was abnormally weak.

An approximate answer at least to this question can be



obtained by means of the "pendulum ophthalmodynamometer." The original form of this instrument was described on page 61 of the first Section of the Transactions of the International Congress of Ophthalmology held at Naples in 1909.

Since that time improvements in it have been made by its originator although the principle was retained. It consists of a thick straight wire or rod suspended like a pendulum from a point projecting horizontally forward from a vertical sheet of brass about five by ten centimeters. When hung in this way the rod acts as a lever, the projecting point being the fulcrum. The upper end the rod extends one or two centimeters above the point on which it is hung, and at its upper end has a thread some 50 centimeters or more attached to it. The other end of this thread is fastened to a pair of very fine forceps.

In order to measure the strength of the internal rectus for example, cocain is first applied until its maximum effect is produced, the lids are held apart by a speculum and the forceps are attached firmly to the tendon of the external rectus. The patient is then directed to look as far as possible toward his left. That causes the upper end of the rod (the pendulum) to follow also toward the left, while the longer and lower end swings toward the right through a certain number of degrees, which are drawn on an arc on the face of the vertical brass plate of the instrument. With the aid of an adjusting weight on the rod, the strength or lifting power of the abductors can thus be ascertained with a considerable degree of exactness.

To measure the power of abduction, the instrument must be placed in front of the patient.

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#### INSTRUMENT FOR DETERMINING THE LOCATION OF OPTICAL IRIDECTOMY.

HARRY S. GRADLE, M.D.

CHICAGO, ILL.

The accompanying corneal contact glass is for the purpose of determining the most suitable location for an optical iridectomy. The cornea should be anesthetized after maximum mydriasis has been obtained. The contact glass is then placed upon the cornea and rotated until the best possible vision is obtained. That determines the best location for the optical iridectomy. The present glass is being improved by having the sector corresponding to the iris coloboma, cut out entirely and will soon be obtainable.

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#### A TEST CARD.

G. A. SULZER, M.D.

COLUMBUS, OHIO.

The characters run from 100 meters to 4 meters. We have two columns, so it is possible to make a quick determination in the region indicating the most acute vision, where we have arranged an unlearnable series, which can be read in twenty directions, so it is not possible to learn the characters by sound or sight. The series runs from a hundred to four meters on the large card, and on the other hand card from .38 the smallest we can see, to 20 meter type. I present this to you for what it may be worth. It is a success in my daily work.

## A NEW TONSIL HEMOSTATIC FORCEPS FOR LIGATION OF VESSELS IN THE TONSIL FOSSA AND OTHER DEEP CAVITIES.

HOWARD V. DUTROW, M.D. and ALFRED G. FARMER, M.D.  
DAYTON, OHIO.

The instrument herein described has been developed in our nose and throat practice. It has proven of such practical value in our hands, that we feel justified in inviting its attention to those of our colleagues who care to investigate its merits for themselves.

Every laryngologist recognizes the value of ligating bleeding points after tonsil enucleation. As a surgical operation, the procedure of tonsil enucleation is not complete until hemostasis has been established, and certainly there is no reason why the ligation of bleeding points is any less rational



or of any less value in the tonsil fossa than in surgery of any other part. We often experienced difficulty, in ligating bleeding points, in getting the ligature free of the end of the hemostat, and after removing the hemostat, we were frequently chagrined to find the ligature come away also, having been knotted around the extreme end of the instrument and not around the bleeding point as desired.

To overcome this difficulty, we have had made an ordinary tonsil hemostatic forceps with the addition of a shoulder on one blade of the seizing end. The shoulder has a slope of about 45 degrees and is about  $\frac{1}{4}$  of an inch high, the peak of the shoulder forming the apex of a triangle with the shaft of the instrument as its base. The bleeding point is picked up in the usual way, the ligature knotted over the shaft

of the instrument and the loop pushed over the shoulder and drawn tight, the incline of the shoulder forcing the loop when tightened over the end of the instrument.

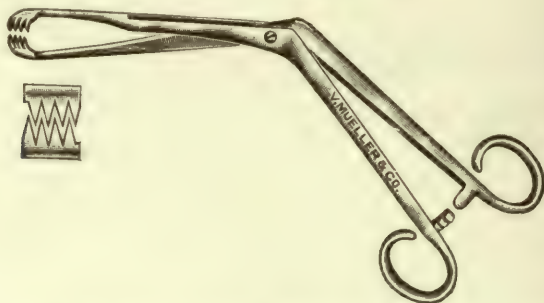
In our work we have found No. 1 Iodized Catgut to meet our requirements in ligature material, to the best advantage. In the throat we have found that a single knot is all that is necessary to retain the ligature and control bleeding.

This instrument would be applicable and practical in ligating a bleeding point in surgery of any deep part, such as gall bladder, where the ligature has to be placed largely by feel.

To those having short fingers or having difficulty in drawing the knot tight down in the throat or other cavity, the suggestion is made that after the loop is knotted it may be placed over the shoulder and tightened by grasping the free ends of the ligature in two pairs of ordinary forceps, and using these to make traction.

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Dr. George B. Jobson, Franklin, Pennsylvania, presented a tonsil forceps—special seizing forceps.



Dr. Samuel S. Quittner, Cleveland, Ohio, presented a device to eliminate the psychic influence during operation—automobile goggles sandblasted to make them opaque—to be put on the patient before going to the operating room.

Dr. Francis Chapman, Milwaukee, Wisconsin, presented a special ice bag for the throat to be used after tonsil operations. The ice is put in at each end and the bag slipped over the patient's head.

Dr. Chapman also presented a paracentesis knife—an instrument whose cutting edges stand at an angle.

Dr. Charles R. Reeves, Greensboro, North Carolina, presented a headlight which affords a light power of 100%.

TRANSACTIONS  
OF THE  
TWENTY-SIXTH ANNUAL MEETING  
OF THE  
**American**  
**Academy of Ophthalmology**  
**and Oto-Laryngology**

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MINUTES

## REQUIESCANT IN PACE.

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- Dr. C. J. Blake, Boston, Massachusetts.  
Dr. F. J. Bowles, New York, N. Y.  
Dr. L. Z. Breaks, Terre Haute, Indiana.  
Dr. H. H. Brown, Chicago, Illinois.  
Dr. C. M. Cain, Indianapolis, Indiana.  
Dr. P. B. Coble, Indianapolis, Indiana.  
Dr. G. F. Cott, Buffalo, N. Y.  
Dr. J. A. Dillon, Springfield, Massachusetts.  
Dr. D. E. Esterly, Topeka, Kansas.  
Dr. L. J. Goux, Detroit, Michigan.  
Dr. W. F. Julien, Gary, Indiana.  
Dr. M. B. MacLean, Chicago, Illinois.  
Dr. J. P. Marshall, Warren, Ohio.  
Dr. A. B. Mason, Waycross, Georgia.  
Dr. F. B. Moore, Memphis, Tennessee.  
Dr. F. T. Reyling, Kansas City, Missouri.  
Dr. J. E. Sawtell, Kansas City, Missouri.  
Dr. G. T. Stevens, New York, N. Y.  
Dr. C. C. Stuart, Cleveland, Ohio.

## MINUTES OF THE 26TH ANNUAL MEETING OF THE AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY.

The opening session of the American Academy of Ophthalmology and Oto-Laryngology was called to order at nine-fifty a. m., October 17, 1921, in the Rose Garden of the Bellevue-Stratford Hotel, Philadelphia, Pennsylvania, by the President, Doctor Emil Mayer of New York City.

DR. EDW. STIEREN, Pittsburgh, Pennsylvania, moved that the reading of the minutes be dispensed with. Motion duly seconded and carried.

The Secretary, DR. LUTHER C. PETERS, Philadelphia, then read his report.

### SECRETARY'S REPORT.

The official Fellowship list, published in 1920 and 1921, shows an enrollment of 1,335. During the year the Academy has lost, by resignation and by death, 25 members. By a ruling of the Academy, the Transactions are forwarded only to those members who have paid their dues in advance—March 1st. Fellows, however, who may be in arrears not more than two years are carried on the membership roll as in good standing. This calls for a duplicate membership list: First, one of those who are in good standing; and second, one of those who have paid their dues in advance and are entitled to receive the Transactions. It has been difficult, therefore, to maintain a correct mailing list. The names of a number of members have been inadvertently omitted from the printed list. Including these omissions and reinstatements, our total membership is now 1,363.

The increasing affairs of the Academy have necessitated a midyear meeting of the Council, which was held in Boston during the convention of the American Medical Association. In addition, special and important matters have been acted on by the Council by a mail vote.

The more important of the Council's deliberations which were thus acted upon since our last meeting are:

First: The inviting of Professor J. van der Hoeve of Leiden, Holland, to be the guest of the Academy at this meeting.

Second: The creation of a Museum of Ophthalmologic and Oto-Laryngologic Pathology as a distinctive phase of

the Academy's scientific field of endeavor. The character and scope of this phase of the work will be presented by the Chairman of the Committee, Doctor Harry S. Gradle.

The question of reduced railroad fares has apparently been unsatisfactory to many of our members this year. The Secretary, through much correspondence, was able to secure a half-fare reduction on return tickets on limited and unsatisfactory conditions. The concessions, however, were the best that could be obtained from the Passenger Association.

The list of applicants for Fellowship is placed on the bulletin board for your careful inspection. Any information in reference to candidates should be communicated to a member of the Council to aid in determining the qualifications of each applicant for Fellowship in the Academy.

Respectfully submitted,

LUTHER C. PETER,  
Secretary.

DR. GEORGE F. SUCKER, Chicago, moved that this report be accepted and placed on file. Motion seconded and carried.

The Treasurer, DR. SECORD H. LARGE, Cleveland, Ohio, then made the following report.

#### TREASURER'S REPORT.

Balance on hand from 1920.....	\$21,359.25	
Receipts for 1921.....	16,614.96	\$37,974.21
		<hr/>
Disbursements for 1921.....		6,922.68
		<hr/>
Balance on hand.....		\$31,051.53

The CHAIR then appointed as an Auditing Committee, Doctors John W. Murphy, Cincinnati, Ohio; George F. Suker, Chicago, Illinois, and Thomas E. Carmody, Denver, Colorado. The Report of the Treasurer was referred to this committee.

DR. EDWARD B. HECKEL, Pittsburgh, Pennsylvania, made the following report for the Committee on National Medical Research Laboratory.

#### REPORT OF THE COMMITTEE ON A NATIONAL MEDICAL RESEARCH LABORATORY.

At the meeting of the Academy two years ago, a paper was presented showing that medical studies, especially those of the eye, ear and throat, could be much more effective if

coordinated with each other by some central organization, preferably by one connected with the National Government. As a result, this committee was appointed "to report at some subsequent meeting what recommendations, if any, this Academy should make with a view to the establishment of a National Medical Research Laboratory."

The importance of this question was such that it was not deemed advisable to attempt any report last year. It must be confessed even now that only slight progress has thus far been made. Great movements are slow in starting. It is proper, however, for this committee, without further delay, to state briefly the reasons for taking up this problem, just what it is now, and what the difficulties are in solving it.

1. *Previous efforts to organize Federal Care of Public Health.* Of course there was nothing original in the proposition to place all official medical activities, and especially the Public Health Service, under governmental control. That plan has been adopted in practically every other civilized country. For several years past, the committees on Legislation and on Public Health of the American Medical Association have separately or together bent their efforts towards the development of a plan to enlarge the scope of the present excellent Public Health Service and associated similar activities, to organize them all as a department of the Government with a representative in the Cabinet of the President. Thus far these efforts of the American Medical Association and of legislators in sympathy with our profession have been thwarted by three opposing agencies. These are:

(A) The patent medicine industry, supported by the many millions of dollars invested in it;

(B) Irregular practitioners of medicine in their various cults, all of whom appreciate that under Federal control their opportunities for fleecing the public would be much curtailed; and

(C) The ignorance of the public, this last being largely due to (a) the teaching of so-called physiology in the public schools, which is defective, consisting largely of tirades against alcohol, and (b) the general disregard in college curricula of physiology and certain allied branches, a knowledge of which tends to improve the health of the individual and the physical and mental qualities of the nation.

In spite of this opposition, the health agencies of the

Government have been gradually improved, as shown, for example, by the present crusade against syphilis, and now two or three measures are before Congress awaiting action. In this connection it is only possible to refer to the well known Owen Bill, which in its third modified form was introduced in 1916; to the bills of Senator France, of Mr. McDuffie, and especially to the Kenyon Bill (Senate 1607) with the McCormick Bill (Senate 1839), and the Towner Bill (House 2366). The best recommendation of the first and of the last two particularly is shown by the opposition which they have aroused from quack medicine manufacturers and from irregular practitioners.

Other excellent efforts have been made in the interest of public health and for the advance of medical research by the utilization of departments already long existing. One of these, for example, is the arrangement proposed by Doctor Gradle and others to obtain the cooperation of the Army Medical Museum in the establishment of a Museum of Ophthalmic Pathology conjointly with the American Academy of Ophthalmology and Oto-Laryngology. Again brevity requires that these be passed hastily. All of these efforts, however, show an appreciation of the desirability of better methods by thoughtful men in our profession and by legislators.

This general glance at efforts which have been made towards Government aid of public health is necessary in order to understand the second point in this report, namely;

II. *The Scope and Object of a National Research Laboratory.* The name might suggest the establishment somewhere of some one central and perhaps costly institution. That is not the idea. It is rather to utilize the opportunities already existing in the Library of the Surgeon General, in the Army Museum, in the Public Health Service and elsewhere, to facilitate research and to place students in communication with each other.

It is certain that a very large part of the research attempted and of publications before societies simply represents a duplication of what is already known. That would not be if the authors had sufficient opportunity to inspect the literature of their subjects.

This means that one important function of a National Research Laboratory would be not only to continue the Index

Medicus, but gradually to form a card catalogue of abstracts of the more important publications. This catalogue, in addition to the name of the author, subject and journal, would give an abstract of the article or monograph made by an expert on that particular subject. If only one or two hundred copies of such card were printed, similar to the cards issued by the Library of Congress, and if these were distributed to as many libraries in this and other countries, that alone would justify the formation of such a research laboratory.

A second function of such a laboratory would be to place students who are working at the same problems, but in different localities, in communication with each other, in order that they may learn each others' methods and results more promptly and informally than would be possible from publications.

Numerous other functions of such a laboratory might be enumerated, but brevity in this report makes that impossible. Moreover, the services which such an institution might render have already been given in a paper in the Transactions of the Academy, by the Chairman of this Committee, entitled "A War Crisis in the Advance of Medicine—Especially in Ophthalmology."

It would take too long to explain the methods by which it is hoped to obtain ultimately the organization of a National Research Laboratory on this general plan, or to obtain the same advantages by other methods and perhaps under another name. These details must be left for consideration later, either by this committee, if it seems worth while to continue it, or by some subsequent committee. In any such efforts now or in the future, it does not seem wise for this Academy or for any group of specialists to attempt independent Federal legislation. Instead, we would recommend the adoption of a resolution similar to or identical with the following, namely:

"RESOLVED: That the members of the American Academy of Ophthalmology and Oto-Laryngology be urged to further the enactment of such legislation as has been recommended by the officers and committees of the American Medical Association.

"RESOLVED: That the Academy also call upon medical organizations similar to this to interest themselves in the creation of a Department of Public Health, under Federal control, whose powers shall be much greater than those now existing, one section or bureau of which shall be so organized as to foster research in public or

private laboratories, such section or bureau being similar to that here described as a National Medical Research Laboratory."

Lucien Howe.

Emil Mayer.

Edward B. Heckel.

DR. GEORGE F. KEIPER, Lafayette, Indiana, moved that this report be accepted and spread on the record, and that the committee be continued. Motion seconded and carried.

DR. EDWARD JACKSON, Denver, Colorado, then made the report for the Committee on International Congress, as follows:

REPORT OF THE COMMITTEE ON THE INTERNATIONAL CONGRESS.

I have only a verbal report to make, and very little to add to what has been previously reported and published, because the General Committee will meet this week and probably take some important steps that will be announced through the bulletin that is sent to all who become members of the Congress.

The circumstances under which this Congress is being held are such that we have to meet certain handicaps. One is the feeling that still exists between our late allies in the war and our late enemies, and although peace has been declared the feeling is still there. Very early in the arrangements we had to decide on a policy, and then more than a year before we were at technical peace with Germany it was decided that we would consult largely the feelings—if we had to take sides, as we did to some extent—of our late allies. This was shown in the official languages which were chosen—French and Spanish, not including German; also in the invitations, which could only be issued at that time to those countries with which the United States was in harmonious relations. That is one handicap.

Another handicap is the financial condition all over the world, and the very low rate of exchange with certain countries—the mark worth only about one cent and the franc worth very much less than par; even the sterling exchange of Great Britain has been greatly decreased, although it is coming up. That constitutes a very serious handicap for those foreign ophthalmologists who would otherwise probably visit our country.

In spite of that, however, we shall have some of the best known ophthalmologists of the world at our meeting. From some we will have papers of very great interest, and from

some others discussion. Some of them have been in this country before; others have never visited America. It is too soon to announce names—things may occur at the last moment that will keep some of these men from coming, and we do not want to make promises prematurely.

We have also a very fair list of papers promised from abroad, but the secretary advises that the number of papers promised from this country at the present time is not satisfactory. I think we ought to hear within the next month from those who are preparing papers to be read before the International Congress. This is not only a chance to listen to these men from across the Atlantic and the Pacific, but it is a chance to place American ophthalmology before them in a way that will be more definite and more convincing than we have ever before had opportunity to do. Not all of the program by any means, but part of it should be good stuff of American authorship. These papers must be in the hands of the committee on scientific work by January 1st. We propose to have a pre-session volume, as has been published by the Section on Ophthalmology of the American Medical Association for several years, which will abbreviate the time of presenting papers at the Congress and make the sessions very much more interesting, so we must have these papers in our hands at an early date.

It is proposed that on one of the evenings some form of entertainment be given, that will enable the members of the Congress to meet and get acquainted with each other. The other evenings while the Congress is in session will be devoted to special lectures and demonstrations. Most of these have been arranged for, and they will be announced through the bulletin sent out in a few weeks.

There is one other point. I think American ophthalmologists should be aroused to the importance of having a large membership that will give us sufficient funds for the expenses of the Congress and for the entertainment of our foreign guests. If we had such a registration from this country as they had from Switzerland when the Congress met at Lucerne, we would have over 1500 members from the United States. At the last account we had only about one-half that number. Of course many are leaving it until the time of the meeting; but they will find it much more satisfactory to send their fee to Doctor Parker, the chairman of the Membership Committee.

at once, and get in touch with the plans for the Congress through the bulletins that are being issued.

One more point that ought to be borne in mind and thought about in every section of the country, is that many of our visitors will wish to see the United States and see it under the most favorable circumstances. That will be work for local organizations—to entertain these men in the different cities and to show them the scenic parts of the United States, for they are coming not only for the ophthalmology, but to see some of our big country and our scenery. These local organizations ought to be formed and in working order within the next two or three months, and unless we have a good membership to draw from, it will be rather difficult to form them in some parts of the United States.

This is the report of progress we have to make at the present time.

EDWARD JACKSON.

It was moved that this report be accepted and the committee continued. Motion seconded and carried.

DR. HARRY S. GRADLE, Chicago, gave the report of the Committee on The Museum of Ophthalmic and Oto-Laryngologic Pathology.

REPORT OF COMMITTEE ON MUSEUM OF OPHTHALMIC AND OTOLARYNGOLOGIC PATHOLOGY.

I have nothing but a verbal report to make, as the majority of our work was submitted to you in the letter that went out with the program of the Academy.

To recapitulate, therefore, there has been effected a union between the American Academy and the Army Medical Museum, with the hopes of establishing a National Museum of Ophthalmic and Oto-Laryngologic Pathology. The American Academy can contribute material which the Army lacks; and, on the other hand, the Army can supply the home for the museum and the technicians necessary to prepare specimens. But they have not the trained pathologists in ophthalmology and oto-laryngology necessary for final diagnosis, and to that end a Committee on Ophthalmology and Oto-Laryngology, men specially trained in the pathologic features, is being formed. The method of work is, briefly, as follows:

Any member having a specimen that he wishes to have studied, or one that is of unusual interest, will send such

specimen to the Army Medical Museum, section on ophthalmic and oto-laryngologic pathology, accompanying the specimen with a rather complete protocol of the case. The Museum will section it and study it as far as they are able and then refer it to the Committee on Pathology, who will give the final decision. The donor of the specimen will be sent a copy of the report together with such photographs as may be necessary, and the remainder placed on file in the Army Medical Museum in Washington. This section is then open for study by any reputable physician, to be passed upon by the curator of the Army Medical Museum. Furthermore, the Museum will have at the annual meeting of the Academy, an exhibit of the interesting cases sent in during the year. In that way we hope in the course of time to have a National Museum of Ophthalmic and Oto-Laryngologic Pathology that will be second to none in the world.

I also wish to announce that, in order to start the thing properly, Doctor Joseph Beck has conveyed the major portion of his extremely extensive collection of histologic and pathologic specimens of ear, nose and throat to this Museum, and we hope that his extremely unselfish example will be followed by other men who may have interesting and unusual specimens.

HARRY S. GRADLE.

DR. NELSON BLACK, Milwaukee, moved that this report be accepted and placed on file, and that the thanks of the Academy be extended to the committee and to Doctor Joseph Beck for the start they have given this important movement. Motion seconded and carried.

DR. EDWARD JACKSON, Denver, Colorado, made the following report for the National Board for Ophthalmic Examinations:

REPORT OF NATIONAL BOARD FOR OPHTHALMIC EXAMINATIONS.

During the past year an examination was held at Boston just preceding the meeting of the American Medical Association, and one is being held to-day at the Will Eye Hospital in Philadelphia.

The number of applicants granted the certificate of the Board within the year is about 100, making 250 from the organization of the Board to this date. It is not always prac-

licable to state the exact number of those granted the certificate, because some who make an excellent showing in every other direction reveal a very defective knowledge of some particular subject. In such an instance the granting of the certificate is deferred until the applicant can gain a better acquaintance with that subject, and demonstrate a knowledge of it before an individual examiner designated to reexamine him. The practical subjects in which defective training has been most frequently revealed are the ocular movements and the field of vision.

It is sometimes asked, "What has the Board done with the amount received from the fees of those granted its certificates?" The following is the financial statement covering the incumbency of the present treasurer, Doctor William H. Wilder, from July 5th, 1918, to October 17, 1921.

#### TREASURER'S REPORT.

Covering the period from July 5, 1918, to October 17, 1921.

##### *Cash Receipts*

July 5, 1918	Initial Deposit (from preceding	\$1813.37	
	Treas., Dr. Todd).....		
1919	Examination fees.....	349.70	
1920	Examination fees.....	1823.05	
1921	Examination fees.....	1298.40	\$5284.52

##### *Expenditures*

P. F. Volland Company, certificates.....	\$ 657.08	
26 fees returned.....	650.00	
Examination Assistants' Fees.....	20.00	
Minnesota Loan Trust Co.,		
Dr. Todd's Estate.....	103.38	
Miscellaneous Expenses of Board.....	253.40	\$1683.86

Cash on hand, Merchants Loan &  
Trust Company, Chicago,

October 12, 1921..... \$3600.96

The balance now carried in bank has been accumulated as a reasonable working balance for the business of the Board, by two methods of saving. First, the expenses for permanent office and stenographer and office attendant have been practically eliminated by association with the American College of Surgeons. Second, nothing has been paid during this period to members of the Board for travelling expenses to the place of examination, although these have been particularly heavy during the period in question, and often repeated trips have

been necessary to make the necessary arrangements. Having thus accumulated a proper fund it will be the policy of the Board to pay some part of the actual expense that travel to the place of examination entails upon those who conduct them.

On behalf of the Board,

EDWARD JACKSON.

It was moved that this report as read be adopted and placed in the minutes, and that the committee be continued. Motion seconded and carried.

DR. JOSEPH C. BECK, Chicago, chairman of the Committee on Examinations in Oto-Laryngology, made the following report:

REPORT OF COMMITTEE ON EXAMINATIONS IN OTOLARYNGOLOGY.

We had three meetings, including one which was held on the 14th of this month at the Medico-Chirurgical in which we had eighteen applicants for examination. That date was a little unfortunate, so it was decided last night that we would have another examination tomorrow afternoon at three o'clock at the Medico-Chirurgical. Any applications to the secretary will be acted upon at that time.

We divide our examinations into three types of men. The first group are the men who have had the minimum requirements—say a year or between the first and second year. They are examined both orally and in writing. The second group are those who have been five years in practice; we have a conference with these men. The third group are those who have been in practice more than five years, and these men simply come in and meet the members of the Board and that is all there is to that examination.

This is in no way related to the Board of Ophthalmology that issues certificates. We make no charge for this as we feel it an honor to be on this committee and examine these gentlemen.

JOSEPH C. BECK.

DR. JOHN W. MURPHY, Cincinnati, Ohio, moved that this report be accepted. Motion seconded and carried.

DR. GEORGE F. KEIPER, Lafayette, Indiana, asked what steps were being taken to cooperate with the American Laryngological Association, the American Otological Society, and the Triological Society, with a view to having a board simi-

lar to the Ophthalmic Board of the Academy. Dr. Beck replied:

"This matter has been very carefully considered. It was the intention when the Council appointed this Board, that we should get together with these other gentlemen, but that takes time. We have had to wait on them. Every member of our Board is a member of all the national societies, and yet it takes time to develop this. But we hope in the end to have the same kind of a board that the ophthalmologists have. The College of Surgeons is very anxious that we should have such an oto-laryngologic board, and the Academy is getting a great deal of credit for the effort.

DR. HARRY S. GRADLE, Chicago, made the following report:

REPORT OF COMMITTEE ON GRADUATE COURSE IN OPHTHALMOLOGY AND OTO-LARYNGOLOGY.

Here, too, I have only a brief verbal report to make. The report will depend a great deal on how the course goes—whether you like it or not.

Before I go any farther I would like to say that whether this course is a success or not, there is one man in the Academy that we have to thank for any good that comes out of it, and that man is our Treasurer, Doctor Large. The post-graduate course is the outgrowth of his brain and I think we are all deeply indebted to him for the opportunity to try it out.

The committee has done quite a bit of work, but the majority of the work has been done by Doctor Wherry of Omaha. The smoothing out of all the details is due to his untiring work. I wish to take this opportunity before the Academy to express the appreciation of the Committee to Doctor Wherry for the efforts he has expended.

As regards the course itself, there is little to tell you except that we hope it will satisfy you and give you what you want.

HARRY S. GRADLE.

It was moved that the report be accepted and placed on file, that the thanks of the Academy be extended to the chairman, and that the committee be continued. Motion seconded and carried.

DR. ROSS H. SKILLERN made some announcements on behalf of the Entertainment Committee, and the Business Session adjourned.

## JOINT SESSION.

Immediately following the adjournment of the Business Session the Scientific Session was called to order by the President, Dr. Emil Mayer of New York City.

DR. EMIL MAYER: Before proceeding to the regular order of the program I take great pleasure in announcing to you that from the land of dykes and canals, from the land of spotless towns, from the great university at Leiden there has come to us a distinguished guest. Professor J. van der Hoeve is with us and I am very glad to introduce him to this gathering. I would like to say in this connection to Professor van der Hoeve and to our other guests, that they are invited to take part in our discussions.

The first order of business will be the presentation of the gavel by Doctor Lee M. Francis.

DR. LEE M. FRANCIS, Buffalo, New York: The wood from which this gavel is fashioned came from the operating chair long used by our first president, Doctor Adolph Alt. It bears the names of his successors.

It is a great pleasure, sir, to present it to the Academy in appreciation of the signal honor this society bestowed upon me, and as a memorial to Doctor Adolph Alt, cofounder and first presiding officer.

DR. EMIL MAYER, New York City: It is my pleasant duty on behalf of this Academy to accept this gavel which you have so generously presented this association, and to express our appreciation not only of the gift, a further evidence of your loyalty to this institution, but also of the beautiful sentiment displayed in having the gavel as a part of the belongings of our highly esteemed first president of the Academy, Doctor Adolph Alt.

The motives that actuated you to make this presentation are well exemplified in that splendid feeling of brotherhood that has made this Academy the strong and powerful organization that it is, and in this you have borne more than your share.

For seven years its most active guiding spirit as Secretary, your patriotic service to your country so that one of the silver stars on the service flag of the Academy was wholly and entirely yours, your successful Presidency last year at the twenty-fifth anniversary of this Academy, and your continued work as a member of the Council, are all evidence not

only of your own work, but of the high and affectionate regard that the Academy holds for you.

This gavel with its inscription will last for many years. May it witness a striving for the best and highest scientific ideals, as well as a continued close union of that fraternity that already exists.

Before making use of this gavel I shall ask the members of this Academy to rise when three raps of the gavel are given, in honor of our deep appreciation of your gift, as well as in memory of our beloved first President. I shall ask that you give the necessary signal.

DR. EMIL MAYER delivered the President's Address, Doctor Robert Ridpath of Philadelphia occupying the chair.

It was moved by Dr. Edw. B. Heckel of Pittsburgh that this address be referred to the Council for action. Motion seconded and carried. After the reading of the papers and their discussion, the meeting adjourned.

#### BUSINESS MEETING, TUESDAY, OCTOBER 18, 1921.

Meeting called to order at 9:45, by the President.

#### REPORT OF THE COMMITTEE FOR THE INVESTIGATION OF IRITIS AND IRIDO-CYCLITIS:

DR. FINNOFF: In the past years the method of investigation formerly employed by the Committee has not been changed. The assistance of a large number of ophthalmologists was solicited and printed in syllabi, covering the personal and family history, description and symptoms, laboratory investigation, treatment, etc., which were furnished to assist in carrying out a thorough and uniform search for the cause of iritis and irido-cyclitis.

The committee believed that the records would be of little value, unless all known factors which might produce iritis and irido-cyclitis had been searched for.

In the two years in which the committee has been functioning, ninety-two cases have been collected and classified as follows:

Focal infection (teeth).....	26
Focal infection (tonsils).....	13
Autointoxication .....	29
Syphilis .....	14
Gonorrhea .....	3
Sympathetic ophthalmia .....	2
Undetermined .....	5

The greatest number, i.e., thirty-nine, of the cases were due to focal infection. Next in order comes autointoxication; then next is syphilis, and so on.

We believe the assumption that irido-cyclitis was due to focal infection because the symptom subsided after the removal of teeth or tonsils is not conclusive evidence that the eye condition was primarily or even entirely due to this condition. In order to prove this point, we believe that it is necessary to eliminate as far as possible all other known causative factors.

Eight cases have proven to be due to focal infection by reproducing the disease in animals, after inoculation of infected material obtained from the causative focus. The diagnosis of autointoxication was based, in several instances, on the fact that the patient improved after eliminative treatment was instituted. This is not sufficient, in the opinion of the committee.

About ninety percent of the syllabi received by the committee were incomplete.

The committee believes that the method of investigation employed by this and former committees is unsatisfactory. We suggest that the work be continued by a committee in which all the members are located in large clinical centers where the necessary laboratory facilities are at hand to carry on a complete search for the cause of each case, under the supervision of a member of the committee.

John Green Jr.,

William L. Benedict.

William C. Finnoff, Chairman.

On motion of Dr. Allan Greenwood, of Boston, duly supported and carried, it was ordered that the report of this committee be accepted and the committee continued.

DR. JOHN M. INGERSOLL, for the Council, presented a report as follows: This report is with reference to changes in the constitution, and it refers to applications for membership. At present the Constitution reads that the applicant for membership or place on the program must possess a certificate provided by the Ophthalmologic Board or the Board of Otolaryngology, or a certificate from a recognized college in either one of these branches.

The reason we have suggested the change in the constitution is that a member when admitted automatically becomes

eligible for the program. As it is now, if the Constitution is rigidly enforced, the Section on Oto-Laryngology would go out of existence, because there has been no board to grant a certificate. The present board is not granting certificates. We hope it will occupy the same ground the ophthalmologic board occupies, and it will be granted to them. The point is that if a man is eligible for membership, he is eligible for program.

The change in the constitution proposed is as follows:

"All applicants for membership must be approved by the American Board for Ophthalmic Examinations or the Oto-Laryngologic Examining Board designated by the Academy.

This merely gives them some definite knowledge in regard to a man's qualifications to practice in either field or both fields if he selects. We submit this as a recommendation for amendment to the constitution.

THE CHAIR: This will necessarily lay over on the table for the usual period, that is one year from the present meeting.

#### REPORT OF THE NOMINATING COMMITTEE.

DR. INGERSOLL: The Council recommends the following men as officers of the Academy for the ensuing year:

For President, Dr. Walter Parker, of Detroit.

First Vice-President, Dr. R. H. Skillern, of Philadelphia.

Second Vice-President, Dr. W. L. Benedict, of Rochester, Minnesota.

Third Vice-President, Dr. John J. Shea, of Memphis, Tenn.

Treasurer, Dr. Secord H. Large, of Cleveland, Ohio.

Secretary, Dr. Luther C. Peter, Philadelphia.

Editor of Transactions, Dr. Clarence Loeb, of Chicago, Ill.

For Members of Council, Dr. Hanau W. Loeb, St. Louis, Mo., and Dr. Alfred Stieren, Pittsburgh, Pa.

THE CHAIR: There are so many members who have not received a copy of the Constitution and By-Laws that I will state for their benefit, that it is permitted to make any nominations from the floor, if you so desire. The Council has gone into the qualifications of these men and submit their opinion only as to what they consider best.

DR. GEORGE F. KEIPER, La Fayette, Indiana: I move you that we elect the officers named by a rising vote.

THE CHAIR: There will not be an election until tomorrow.

DR. KEIPER: I then move that the nominations be closed.

THE SECRETARY: The next place of meeting will be the Twin Cities, with headquarters in Minneapolis. The time will be set by the Council, probably the last part of September.

Questions for the Round Table Discussion should be submitted promptly and should be signed. Admission is by badge, so it is important to wear your badge.

THE CHAIR desires to announce this is merely as an evidence of good faith.

Amendments are now in order as printed on your program.

Article 3, Section A, to be amended so as to read: "shall have been practicing exclusively for at least one year." The word "exclusively" is the one proposed.

DR. LEE MASTEN FRANCIS, Buffalo: I move its adoption. Motion seconded and carried.

THE CHAIR: Same Section A to be amended so as to read, after the clause "the annual dues of ten dollars": "such application should be filed with the secretary at least thirty days before the annual meeting, and the list thereof shall be sent to the Fellows with the notice of the annual meeting."

DR. SECOR H. LARGE, Cleveland, Ohio: I move its adoption. The motion is seconded.

THE CHAIR: This is proposed so as to bring before each member, before he comes to the sessions, the names of the men to come up. We have difficulty each year in posting our list. It must be posted twenty-four hours, and we feel we will be better enabled to judge of the particular qualifications of each candidate.

DR. W. H. WILDER, of Chicago: I would like to inquire if this includes the information so they would know what to do to get their applications at the proper time before the American Board for Ophthalmic Examinations; and the reason I ask is that as secretary of the board, I have received communications from many proposed applicants for membership who are not correctly informed as to just what is necessary for them to do, and I am wondering if something could be incorporated in the amendment, so that they would get this proper information.

THE CHAIR: Would you suggest that this amendment be printed on the head of each application?

DR. WILDER: One of the essential requirements is that he cannot become a member until he holds the certificate of the Board. He gets this not from the board but from the Secretary of the Academy.

THE CHAIR: Would you make an amendment to have this place on the application?

DR. WILDER: The secretary can tell how it reads.

THE SECRETARY: There is a clause on the application and the applicant is instructed as to what is required. Your name is printed there and he must get the information from you as to what the requirements of the board are.

THE CHAIR: Does that answer your question, Dr. Wilder?

DR. WILDER: It does, I believe.

The motion to adopt the amendment as printed was carried.

THE SECRETARY: At the Council Meeting yesterday, it was proposed that the officers elected be installed as usual, but that the incumbent officers be held over until the night of the postgraduate congress, instead of at the end of the session on Wednesday, of this week.

THE CHAIR: The president will be elected and installed as usual, but the present officers will be held over until the postgraduate work is complete.

DR. INGERSOLL: I move that this proposal of the Council be accepted. The motion was seconded and carried.

DR. WALTER LANCASTER, of Boston: The American Optical Society proposes to celebrate the centennial anniversary of the birth of Helmholtz at their meeting, and they have invited us to send delegates. I move that the President be authorized to select delegates for this celebration. Of course Helmholtz is not only a great man in ophthalmology, but he has also done a great deal in oto-laryngology. The meeting will be of a high order of interest, and all who care to attend will be welcome. It will be in Rochester, New York, next Monday. That is a motion.

The motion was seconded and carried.

The Academy then took up the scientific program.

#### BUSINESS MEETING, WEDNESDAY, OCTOBER 19.

The meeting was called to order by the Chairman, Dr. Mayer.

#### REPORT OF THE AUDITING COMMITTEE:

DR. JOHN MURPHY, of Cincinnati, Ohio: The auditing committee of the Academy has carefully examined the account of the Treasurer and has found the same perfectly correct in all respects. The Committee takes this opportunity of complimenting Dr. Large for his devotion to his duty.

CHAIRMAN: You had the report of the Nominating Committee at an earlier meeting. The senior member of the Council will read again the names put in nomination by the Council.

DR. INGERSOLL: The list as read is as follows:

For President, Dr. Walter Parker, of Detroit, Michigan.

First Vice-President, Dr. R. H. Skillern, of Philadelphia.

Second Vice-President, Dr. W. L. Benedict, of Rochester, Minn.

Third Vice-President, Dr. John J. Shea, of Memphis, Tenn.

Treasurer, Dr. Secord H. Large, of Cleveland, Ohio.

Secretary, Dr. Luther Peter, of Philadelphia.

Editor of Transactions, Dr. Clarence Loeb, of Chicago.

Members of Council, Dr. Hanau W. Loeb, of St. Louis, and Dr. Edward Stieren, of Pittsburgh, Pa.

DR. GEO. F. SUKER: I move that the nominations be closed and that the Secretary cast the ballot for those candidates named.

THE SECRETARY: The ballot is cast.

THE CHAIRMAN: The ballot has been cast and the candidates nominated are declared elected.

THE CHAIRMAN: It is necessary that a member of the Ophthalmic Examining Board be named, and the Chairman of this Academy takes pleasure in naming Dr. John R. Newcomb, of Indianapolis.

I have also to announce to members that they should not make the mistake of failing to visit the exhibition of instruments which will be held here for the next three days. They are very important adjuncts to the scientific sessions of this Academy.

There will be an exhibition of instruments in the otologic section before the papers are read.

The senior member of the council will be good enough to present reports from the Council.

DR. INGERSOLL: The Council makes the following recommendations: Dr. Hal Foster, of Kansas City, and Dr. Lucien Howe, of Buffalo, shall be made life members of the Academy of Ophthalmology and Oto-Laryngology. (Great applause.)

DR. JOHN KEIPER, of La Fayette: I move that the recommendation be adopted. Motion seconded.

THE CHAIR: It has been moved and seconded that Dr. Hal Foster, and Dr. Lucien Howe be made life members of this

Academy. Dr. Lucien Howe, it gives me great pleasure to extend to you this little token of our love and respect.

DR. LUCIEN HOWE: This is a big surprise to us, and words are insufficient to express our pleasure and appreciation.

DR. HAL FOSTER: I appreciate this honor very highly and thank you very much for it. (Applause.)

DR. INGERSOLL: The Council also recommends that Dr. van der Hoeve, our guest, be made an honorary member.

DR. SUKER: I move that this be accepted.

DR. MURPHY: I second the motion. Motion carried.

DR. INGERSOLL: We all listened with interest to our President's address. He made certain recommendations to the Council for action. The Committee of Publicity and Service of the Council recommends the appointment of a committee of four on Publicity and Service.

Motion seconded.

A MEMBER: I move that four members, two from each section of the Academy, be appointed. Seconded and carried.

THE CHAIR: The nominations will be announced later.

DR. INGERSOLL: The Council further recommends that all charts and slides and other means of visualization used in the Graduate Course and paid for by the graduate committee, shall be the property of the Academy. Between three and four thousand dollars has been expended, which has to come out of the Academy's fund.

MEMBER: How is it proposed to keep these?

THE CHAIR: That has not been decided.

DR. ROBERT SCOTT LAMB, of Washington: I would suggest that they be placed in the Ophthalmologic exhibit that will be a part of the Army Medical Museum at Washington.

DR. HARRY GRADLE: Arrangements have been made to list and put out an index, and they will be available to any member of the Academy for research, for illustrating papers for purposes of teaching. They will be available for those who desire them.

Motion that this recommendation be adopted was seconded and carried.

THE CHAIR: A suggestion has been made to me which I think will bear fruits, that at subsequent meeting a voice amplifier be placed in the hall, so that those with weak voices, amidst the outside sounds, will be heard to better advantage. I am sure the council will take the proposed action in this regard.

THE SECRETARY: On account of the inability to get the report from the Oto-Laryngological Section, it will be impossible to elect our Fellows at this meeting; but they will be elected at two o'clock this afternoon, as the first order of business, before the program.

The Committee on International Congress will meet on Saturday evening at 6:30 instead of 8 o'clock as announced. We will meet at the Union League and dine together, which will give us an hour and a half more than we expected.

The meeting is adjourned.

#### AFTERNOON SESSION.

Meeting called to order by the President, who presented Prof. van der Hoeve:

PROF. VAN DER HOEVE, of Leiden, Holland: I am sorry I was not in the business meeting this morning when I was elected to honorary membership in this Academy; but I felt that your business was not my business.

Yesterday I told you that I thought it the greatest honor ever bestowed in a life time that the Council invited me as a guest to this meeting, and yesterday at the dinner I expressed gratitude to the committee for that honor. Now you bestow on me a larger, greater honor, and in correspondence with that my gratitude is more, for in the first place it was due to a few of you, and now to all the members that I am indebted for the great honor of making me an honorary member. I was beginning to feel at ease, and now I am quite at home, and cannot better express my gratitude than by saying I am glad I am one of you and a part of this most distinguished Academy of Ophthalmology and Oto-Laryngology.

PRESIDENT MAYER: I can say in regard to having this meeting in Philadelphia, that when two weeks ago Prof. van der Hoeve came here he was a Dutchman; now he is a Pennsylvania Dutchman.

In accordance with a resolution of the Academy, I am to appoint a Publicity and Service Committee. This will consist of the following:

Dr. E. B. Heckel, Pittsburg,  
Dr. Lee M. Francis, Buffalo,  
Dr. Chevalier Jackson, Philadelphia, and  
Dr. Jno. B. Murphy, Cincinnati.

SECRETARY: I am requested to announce that the meeting to-night will be the opening of the Graduate Course, and will

be in the Ball Room of this hotel at eight o'clock promptly.

I have thirty-two new names to present for membership, as acted upon by the Council. We have altogether eighty applicants. Many of these did not appear before their respective examining boards to be passed, and their names will have to go over for ratification until the next meeting. The following have been passed and may be balloted for to-day.

The secretary read the list.

Alden, Arthur Maxwell

Walter Reed U. S. A. Gen. Hosp., Wash., D. C.  
 Arrell, William.....317 Main East, Hamilton, Ontario  
 Bahn, Chas. A., 722 Maison Blanche Annex, New Orleans, La.  
 Ball, James Moores.....4500 Olive St., St. Louis, Mo.  
 Beattie, William Henry.....252 Genesee St., Utica, N.Y.  
 Boerner, Morris H.....Scarborough Bldg., Austin, Texas.  
 Boone, John Calhoun.....315 Dean Bldg., South Bend, Ind.  
 Brickley, Daniel Webster...196 W. Center St., Marion, Ohio.  
 Brown, Mortimer George...802 Univ. Bldg., Syracuse, N. Y.  
 Butler, Margaret F.....1831 Chestnut St., Phila., Pa.  
 Buvinger, Charles Winfield

50 Washington St., East Orange, N. J.  
 Coates, George Morrison.....1736 Pine St., Phila., Pa.  
 Cohen, Samuel.....1626 Spruce St., Phila., Pa.  
 Davis, Frank C.....Lewistown, Mont.  
 Deboe, Michael Price.....Key West, Fla.  
 Dennis, Edward Parker.....311 W. 10 St., Erie, Pa.  
 Dintenfass, Henry.....1714 Pine St., Phila., Pa.  
 Fenton, Ralph Albert...616 Journal Bldg., Portland, Oregon.  
 Ferman, John W.....Charleroi, Pa.  
 Hughes, Thomas Edward, 316 E. Franklin St., Richmond, Va.  
 Husik, David N.....1303 Locust St., Phila., Pa.  
 Jordan, George Thomas...30 N. Michigan Blvd., Chicago, Ill.  
 King, Edward.....605-606 Traction Bldg., Cincinnati, Ohio.  
 Lancaster, Wilson.....Wahpeton, N. D.  
 Lewis, Felding O.....261 S. 17 St., Phila., Pa.  
 Lewis, William W.....836 Lowry Bldg., St. Paul, Minn.  
 Martin, Ancil.....207 Goodrich Bldg., Phoenix, Ariz.  
 McGivern, Charles Steim, 805 Pacific Ave., Atlantic City, N. J.  
 Moore, George Henry....200 Main St., Schuylkill Have, Pa.  
 Radcliffe, McCluney.....1906 Chestnut St., Phila., Pa.  
 Reese, Warren Snyder.....1929 Chestnut St., Phila., Pa.  
 Repass, Robert Eldon, 150 W. Maple Road, Indianapolis, Ind.

Sartain, Paul J. .... 2006 Walnut St., Philadelphia, Pa.  
Schlanser, Adam Edward

Walter Reed U. S. A. Gen. Hosp., Wash., D. C.  
Sharrett, George Oliver. .... The Dingle, Cumberland, Md.  
Simpson, John Reid, 1005 Westinghouse Bldg., Pittsburgh, Pa.  
Stout, Philip Samuel. .... Medical Arts Bldg., Phila., Pa.  
Strouse, Frederic Morris. .... 1301 Spruce St., Phila., Pa.  
Taylor, Charles B. .... Ottumwa, Ia.  
Trible, George Barnett

c/o Bu. Med. and Surg., Navy Dept., Wash., D. C.  
Van Kirk, Frank J. (1920) .... Bellingham, Wash.  
Williams, Walter Henry. .... Middletown, Ohio.  
Zentmayer, William. .... 1506 Spruce St., Phila., Pa.

DR. SUKER: Move that the secretary cast the ballot for the election of these fellows. Seconded and carried.

DR. ELLETT: Speaking for the American Board of Ophthalmic Examiners, a name was read that has not passed that board, and I think something ought to be done about that election, unless he is admitted as an oto-laryngologist.

DR. JOHN NEWCOMB: A resolution presented by Dr. F. Park Lewis was referred to the Council for action, and pursuant to that action I move that the Chair appoint a committee of three with power to act in the establishment of a committee on the further study of the etiology of trachoma, this committee to function with a committee of three from the American Medical Association and a similar committee from the Ophthalmologic Congress. Motion seconded and carried.

The Chair appointed as this committee Dr. Newcomb, Dr. Lewis and Dr. Stucky.

THE SECRETARY: The gentleman to whom Dr. Ellett referred has been passed by both boards and is eligible to membership.

I will add the name of Charles Bohn, of New Orleans, who has passed the ophthalmologic board.

DR. NEWART, of Minneapolis: In behalf of the Minnesota Society of Ophthalmology and Oto-Laryngology, I take this opportunity to express our thanks to the members of the council for their graciousness and the honor of having accepted our invitation to hold the next meeting in the Twin Cities, a thing unprecedented, so far as I know, in the history of St. Paul and Minneapolis. Therefore you will have a double welcome, and we trust you will feel twice anxious to

come to this vacation country. You will be welcomed by the men of the state; our ten thousand lakes should call many of you with your rods and guns, it being the dry season on account of the Volstead act. But you will be welcome just the same. On behalf of the staff of the Mayo Clinic, you will be most welcome there to inspect our institution, which many of you know already.

DR. FOSTER: I think it is fitting at this time that we should pass a resolution thanking our members of the City of Brotherly Love for the manner in which they have entertained us during our stay here. We should thank Dr. Peter, Dr. Skillern and Dr. Ridpath and all their coworkers for the good time they have shown us at this meeting. Philadelphia will be remembered by all of us with great pleasure as long as we live.

The motion was seconded and carried.

The Secretary announces that the names of the candidates as read have been duly elected to this Academy. The others will have to wait until next year. Please note that eleventh hour applicants cannot get in. A certain number of days must lapse before the names can be acted upon.

The Committee on Oto-Laryngology wishes me to announce that they will be prepared to examine any candidates who wish to come up for next year on Friday evening of this week; so that if it is not convenient to go to our next meeting they will have passed their examinations, and will be qualified to come up at that time. Please communicate with Dr. Jos. Beck here in this hotel.

CHAIRMAN MAYER: I wish to make an apology. I am sure you have heard enough of my voice. It reminds me of the story of the deaf old lady who went to church and went up the aisle with her trumpet held to her ear, and smiling at the usher as he escorted her. When he looked at it he said, "One toot out of that, ma'am, and out you go." I will not toot any more. I thank you all for your glorious help. It is difficult to select which I should mention first after our most efficient secretary. There are all those who helped so well on the program, which has been so interesting, that this has been the largest, most enthusiastic and largest attended meeting of the Academy. Whatever poor efforts in my inexperience and youth I have been able to give you I have given gladly. I thank you, and I now hand this precious gavel to my successor, Dr. Parker, and bespeak for him that same

grand democracy, this wonderful feeling that exists in this Academy as in no other institution in America. I thank you from the bottom of my heart, gentlemen. (Great applause, Society standing.)

DR. WALTER PARKER: If the responsibilities of the office of the presiding officer of your Academy are commensurate with the importance of the position the Academy is assuming in medical and educational fields, you will need a superman as your president. I am informed, however, that we already have a superman in our secretary. I was told when I was informed of the nomination and the election, that all I had to do was to obey the orders of the secretary. I now promise to obey the secretary.

No greater honor can come to any man than to be honored by his peers. To have been chosen as the presiding officer for the next meeting of the Academy is one of the greatest honors that has ever come to me. I shall hope through our Secretary, through the committees, and the help I know will come through each and every member of the Academy, to put forth my very best efforts.

CHAIRMAN: I am requested to add the appreciation of the officers to the vice-chairman and the chairmen of the various committees and those who have cooperated to make this such a success.

## INDEX OF AUTHORS AND SUBJECTS.

Abscesses Lung, Localization.....	232
Accessory Sinuses, Nasal, Surgery, Causes Failure.....	374
Acoustic Nerve Lesions, Tonal Range.....	316
Neuromas .....	267
Address, President's.....	1
Advancement, Capsulo-Muscular, Without Incision.....	90
Muscle, Operation .....	83
Anatomy, Aural Surgical, Taught Graduate Students by	
Dissection .....	75
Antrum, Large Growths and Foreign Bodies Removed by	
Moure Operation .....	353
Aural Surgery, Operative, Specimens for Teaching Grad-	
uate Students .....	75
Barkan, Hans .....	9
Beck, Joseph C.....	53
Bedell, Arthur J.....	201
Blepharoplasty for Restoration Socket.....	154
Practical Points.....	161
Blindness, Total, Both Eyes Cured by Drainage Sphenoid	
and Ethmoid Cells.....	348
Bronchoesophagoscopist, Problems.....	243
Brose, L. D.....	209
Card, Test .....	420
Capsulo-Muscular Advancement without Incision.....	90
Cataract, Congenital Anterior.....	209
Chapman, Francis.....	422
Cohen, Martin.....	412
Congenital Anterior Cataract.....	209
Laryngeal Stridor, Epiglottidectomy.....	390
Conjunctiva, New Procedure Plastic Surgery.....	181
Cross, George H.....	34
Dabney, Virginus.....	353
Davis, William Thornwall.....	119
Dean, F. W.....	108
Dean, L. W.....	316
Donovan, John A.....	19
Dutrow, Howard V.....	421
Dworetzky, Julius.....	254
Ear and Eye, Relation.....	395
Industrial Diseases.....	19

Edema, Solid.....	201
Enucleation with Implantation in Tenon's Capsule.....	216
Epibulbar Neoplasms, Malignant, Nonsurgical Treatment	149
Epiglottidectomy for Relief Congenital Laryngeal Stridor	390
Ethmoid Cells, Drainage Cure Bilateral Blindness.....	348
Eye and Ear, Relation.....	395
Magnets and New Model for Use with Dry Cells....	186
Farmer, Alfred G.....	421
Finnoff, William C.....	154
Follicles, Hair, Nasal Vestibule, Acute Infections.....	263
Forceps, Tonsil.....	422
Hemostatic .....	421
Foreign Bodies Removed from Antrum by Moure Opera-	
tion .....	353
Body in Lung, Overlooked.....	229
Francis, Lee Masten.....	181
Fridenberg, Percy H.....	41
Functional Hearing Tests.....	306
Gill, Elbryne G.....	306
Glands, Sebaceous, Nasal Vestibule, Acute Infections....	263
Glaucoma Cases, Unusual.....	119
Gleason, Edward B.....	75
Goggles for Patients to be Operated.....	422
Gradle, Harry S.....	126, 420
Graduate Students Taught Aural Surgical Anatomy by	
Dissection .....	75
Teaching of Ophthalmology, Progress.....	62
Growths, Large, Removed from Antrum by Moure Opera-	
eration .....	353
Nevoid Ocular .....	135
Gullstrand Slit Lamp.....	126
Hair Follicles Nasal Vestibule, Acute Infections.....	263
Headlight .....	422
Hearing Tests, Functional.....	306
Heckel, Edward B.....	149
Howe, Lucien .....	419
Hurd, Lee M.....	263
Ice Bag for Operated Tonsil Cases.....	422
Iglauer, Samuel.....	390
Implantation in Tenon's Capsule.....	216

Industrial Diseases Ear, Nose and Throat.....	19
Ophthalmology .....	34
Trauma in Relation to the Development of Ocular Tuberculosis, Syphilis, and Neoplasms.....	9
Instruments, Presentation.....	412
Iridectomy, Optical, Instrument for Determining Location	420
Jackson, Chevalier.....	229
Jackson, Edward.....	62
Jobson, George B.....	422
King, James J.....	348
Knife, Paracentesis.....	422
Labyrinth Lesions, Tonal Range.....	316
Lamb, Harvey D.....	135
Lamp, Gullstrand Slit.....	126
Lancaster, Walter B.....	186
Laryngeal Stridor, Congenital, Relief by Epiglottidectomy	390
Laryngo-Pulmonary Tuberculosis.....	254
Larynx, Papillomata.....	229
Lateral Sinus Thrombosis Following Mastoiditis.....	341
Lemere, H. B.....	358
Lewis, F. Park.....	224
Lung Abscesses, Localization.....	232
Overlooked Foreign Body.....	229
Lynah, Henry Lowndes.....	232
McCoy, John.....	341
McKinney, Richmond.....	243
Mackenzie, George W.....	295
Magnets, Eye, and New Model for Use with Dry Cells..	186
Malignant Epibulbar Neoplasms, Nonsurgical Treatment.	149
Mastoiditis Followed by Lateral Sinus Thrombosis.....	341
Maxillary Sinus Disease, New Operative and Postopera- tive Treatment.....	358
Mayer, Emil .....	1
Mercury Tonometer.....	412
Miller, Edwin B.....	416
Minutes .....	425
Mithoefer, William.....	374
Muscle Advancement Operation.....	83
Nasal Accessory Sinuses Surgery, Causes Failure.....	374
Vestibule, Acute Infections Sebaceous Glands and Hair Follicles .....	263
Necrology .....	424

Neoplasms, Malignant Epibulbar, Nonsurgical Treatment.	149
Ocular, Relation Industrial Trauma.....	9
Neuromas, Acoustic.....	267
Nevoid Ocular Growths.....	135
Newhart, Horace.....	415
Nonsurgical Treatment Malignant Epibulbar Neoplasms.	149
Nose, Industrial Diseases.....	19
Ocular Growths of Nevoid Character.....	135
Tuberculosis, Syphilis and Neoplasms, Relation In-	
dustrial Trauma .....	9
Ophthalmology and Social Service.....	41
Industrial .....	34
Progress Graduate Teaching.....	62
Optical Iridectomy, Instrument for Determining Location	420
Oration .....	395
Oto-Laryngologic Group, Value in Diagnosis and Treat-	
ment .....	53
Papillomata of Larynx.....	229
Parker, Walter R.....	161
Paracentesis Knife.....	422
Phorometer, Handy .....	418
Plastic Surgery Conjunctiva, New Procedure.....	181
Pollock, Harry L.....	53
Posey, William Campbell.....	83
President's Address .....	1
Prisms for Constant Use.....	108
Quittner, Samuel B.....	422
Ralston, Wallace .....	216
Rectus, Internal, Method Measuring Strength.....	419
Reeves, Charles B.....	422
Rinne Test, Remarks.....	295
Schwabach Test, Remarks.....	295
Study .....	278
Sebaceous Glands Nasal Vestibule, Acute Infections....	263
Shea, John J.....	267
Sinus, Lateral, Thrombosis Following Mastoiditis.....	341
Maxillary, Disease, New Operative and Postoperative	
Treatment .....	358
Sinuses, Nasal Accessory, Causes Failure Surgery.....	374
Slit Lamp, Gullstrand.....	126
Snare, Tonsil.....	412
Social Service and Ophthalmology.....	41
Socket Restoration, Blepharoplasty.....	154

Solid Edema, Case.....	201
Sonnenschein, Robert .....	278
Sphenoid Cells, Drainage Cure Bilateral Blindness.....	348
Stitch, Twin Single.....	83
Stridor, Congenital Laryngeal, Epiglottidectomy.....	390
Sulzer, G. A.....	420
Surgery Nasal Accessory Sinuses, Causes Failure.....	374
Operative Aural, Specimens.....	75
Plastic, Conjunctiva, New Procedure.....	181
Surgical Anatomy, Aural, Taught Graduate Students by Dissection .....	75
Syphilis, Ocular, Relation Industrial Trauma.....	9
Syringe, Tuberculin, Sliding Dose.....	416
Teaching, Graduate, of Ophthalmology, Progress.....	62
Students Aural Surgical Anatomy by Dissection.....	75
Tendon Transplantation.....	83
Tenon's Capsule, Enucleation with Implantation.....	216
Test Card .....	420
Schwabach, Study ..'	278
Weber and Rinne, Remarks.....	295
Weber .....	306
Throat, Industrial Diseases.....	19
Thrombosis Lateral Sinus Following Mastoiditis.....	341
Tonal Range in Lesions Acoustic Nerve and Labyrinth...	316
Tonometer, Mercury.....	412
Tonsil Cases, Operated, Ice Bag.....	422
Forceps, Hemostatic.....	421
Special .....	421
Snare .....	415
Trauma, Industrial, in Relation to Development of Ocular Tuberculosis, Syphilis, and Neoplasms.....	9
Tuberculin Syringe, Sliding Dose.....	416
Tuberculosis, Ocular, Relation Industrial Trauma.....	9
Twin Single Stitch.....	83
Van der Hoeve, J.....	395
Vestibular Organ and Relation Eye and Ear.....	395
Vestibule, Nasal, Acute Infections Sebaceous Glands and Hair Follicles .....	262
Vitreous Body, Observations on Structure.....	224
Weber Test .....	306
Remarks .....	295
Wells, David B.....	418
Ziegler, S. L.....	90

## DISCUSSIONS.

Andrews, A. H.....	314, 351, 386
Barkan, H.....	49
Beck, J. C.....	46, 61, 358
Bedell, A. J.....	132, 208, 215
Benedict, W. L.....	69, 184
Brose, L. D.....	215
Brown, C. M. ....	312
Carmody, T. E.....	261
Carson, W. E.....	223
Cavanaugh, J. A.....	384
Cohen, M.....	72
Cross, G. H.....	50, 158, 178
Dabney, V.....	338
Davis, W. T.....	124
Day, E. W.....	276
Dean, F. W.....	118
Dean, L. W.....	339, 371
Defnet, W. A.....	61
Donovan, J. A.....	50
Dutrow, H. V.....	351, 387
Dworetzky, J.....	261
Ellett, E. C.....	100, 274
Emerson, L.....	117, 197
Ewing, S. A.....	310
Feingold, M.....	225
Finnoff, W. C.....	148, 160, 225
Forbes, H. R.....	251
Fox, L. W.....	101
Fridenberg, P. H.....	51, 73
Francis, L. M.....	152, 196, 222
Gradle, H. S.....	134
Greenwood, A.....	196, 220, 221
Guttman, J. ....	339
Hawley, C. W.....	117, 124, 179, 185
Hays, H.....	266
Heckel, E. B.....	153, 159, 214
Heitger, J. D.....	311, 385
Hessler, F. H.....	134
Holloway, T. B.....	72
Howe, L. ....	115

Iglauer, S.....	394
Jackson, E. ....	73, 197, 208
Jessaman, L. W.....	48
Jobson, G. B.....	158, 178
Keiper, G. F.....	275, 341, 411
King, J. J.....	260, 351
Kopetsky, S.....	345
Lamb, H. D.....	148
Lamb, R. S.....	160, 179, 185
Lancaster, W. B.....	71, 177, 198
Lemere, H. B.....	118, 372, 387
Lewis, F. P.....	47, 133, 226
Lillie, H. I.....	61
Lopez .....	223
Love, L. F.....	104
McCool, J. L.....	104
McCoy, J.....	347, 350
McCrae, T.....	248
McKinney, R.....	253
Mackenzie, G. W.....	315
Mayer, E.....	310, 372, 394, 411
Mithoefer, W.....	388
Mundt, G. H.....	48, 313
Murphy, J. W.....	250
Myers, J. L.....	371
Newhart, H. ....	314
Oppenheimer, S. ....	313
Parker, W. R.....	71
Patton, J. M.....	116, 196
Peter, L. C.....	222
Posey, W. C.....	106, 122
Pratt, F. J.....	387
Ralston, W. ....	223
Ravdin, B. V.....	346
Richardson, C. W.....	252
Roberts, S. E.....	371
Sachs, E.....	276
Schaeffer, G. C.....	159
Shanklin, E. M.....	44
Shea, J. J.....	277
Skillern, R. H.....	383
Sonnenschein, R. ....	314, 338
Spengler, J. A.....	134

Stauffer, F. ....	178
Stieren, E. ....	48, 222
Stueber, F. G. ....	118
Suker, G. F. ....	208, 221
Sweet, W. W. ....	45, 198
Van der Hoeve, J. ....	44, 134, 198
Von Colditz, G. T. ....	388
Voorhees, I. W. ....	276, 311
Walker, C. E. ....	134, 179, 184, 185, 196
Wells, D. B. ....	105
Wiener, M. ....	185
Wilder, W. H. ....	67
Woodruff, H. W. ....	105, 115
Woods, H. ....	123
Ziegler, S. L. ....	106







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